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Greene, C. A.

Fertilizers in
general.

1884.



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Book _____

SMITHSONIAN DEPOSIT.



FERTILIZERS

IN GENERAL

—AND THE—

GREENSAND MARL

—OF—

KING WILLIAM COUNTY, VIRGINIA,

IN PARTICULAR.

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—BY—

Dr. C. A. GREENE

HARRISBURG, PA..

JANUARY, 1884.

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A portion of these pages was read as an essay before the Pennsylvania Sta-
ltural Association, at their annual meeting, held in the Senate Chamber, Janu-
84, by its author, who has for forty years been connected with agricultural
me of which are the Cincinnati Ohio Horticultural from 1858 to 1868. T
ster, Pa., Agricultural Society, for two years, and the Berks County Agricul-
ety for the same length of time.

FERTILIZERS.

The following advertisement appeared in the *Harrisburg Telegraph*:—"Fossil Bones. By request, Dr. C. A. Greene will lecture on Wednesday evening, August 29th, 1883, in the Capitol Building in the Hall of the Representatives on Fertilizers in general and the wonderful deposits of greensand marl in King William county, Virginia, in particular, and will display at the lecture a large quantity of antediluvian bones of quadrupeds, bipeds, fishes, reptiles, together with shells found in this ancient cemetery."

The *Harrisburg Patriot* of August 30th contained the following editorial:

"THE SCIENCE OF GEOLOGY.—DR. GREENE'S LECTURE ON THE MARL OF VIRGINIA.—The lecture of Dr. C. A. Greene, in the house of representatives last evening, is regarded as one of the finest things ever heard there. There were many members of the assembly present, and at the close the general opinion among them was that the lecture was very perfect in the science of geology and very instructive. The illustrations were excellent, consisting of a fine collection of shark's teeth, the bones of fish and of extinct animals. Dr. Greene spoke at length on the marl deposits of Virginia and of their great importance to the uses of agriculture. He gave a description of the Pamunkey river country, in King William county, where the mass of the marl deposit is found, and where the farming communities have known its great value for many years. The members extended hearty congratulations to Dr. Greene at the close, expressing a wish for him to give them another lecture soon again, and the audience, at the instance of Senator Sill, gave him a unanimous vote of thanks. Dr. Greene thinks of giving the public the benefit of the lecture in pamphlet form." Acting President Mylin, Senator from Lancaster, and a farmer of no mean experience, introduced Dr. Greene to the members.

Apology No. 1.

Before perusing these pages, just know that they were made up in scraps, or portions from time to time by the author amidst an excessive amount of work as a physician, and that no effort has been made to especially arrange the subjects, or to write the communications in the best English. The prime object is to bring such an array of statistics before the reader as to interest him in the (to be) marvelous development of the marl in King William county, Virginia.

Unfair Legislation.

It is one of those unfortunate facts, which is self-evident to anyone, that notwithstanding the farmers of the United States are the bone and sinew, and with their families represent 20,000,000 of inhabitants, and really could, if they wished, control the political issues of the country. Yet as a class they have been less represented in legislative acts than any other body of men, that is there are fewer laws made for their interest, and the object of these few lines upon the subject is to attract the eye of the readers of this pamphlet, and let them so manage all their political movements that they shall have every assistance and protection that belongs to them, and has been wrongfully withheld. This is only a general declaration but I could give hundreds of specific cases to prove my assertion if necessary. The lack of any State, or the United States, acting by proper legislation to prevent the enormous destruction of crops by insects is one startling case to the point.

Commissioner of Agriculture.

As cultivating lands is one of the most important avocations, and as the well-being and health of mankind to a certain extent depends upon the good qualities of vegetables, fruit, &c., it is certainly necessary that every state should have its separate commissioner of agriculture and its own experimental college, and once every year all the commissioners should meet together for mutual advantage and interchange of opinions. And, as "Wisdom cometh to the learned man by opportunity of leisure," such men should be selected for the positions as have had the fitting time to prepare themselves for the calling.

Greensand Marl—Some Interesting Facts Concerning the Great Fertilizer.

Dr. C. A. Greene of this city in his recent lecture before the members of the legislature gave a very interesting account of his investigation of fertilizers and especially of the greensand marl of King William county, Virginia. We have been permitted to make an abstract of Dr. Greene's very instructive lecture which is here laid before the readers of the *Patriot*.

Nearly four hundred years ago when Columbus first landed on the soil of North America, he found here a race of people to whom he gave the misnomer of Indians, wrongfully believing that he had landed in a portion of India. The various tribes that were scattered over our vast continent were all uncivilized alike and lived a nomadic life, erecting their wigwams, and temporarily locating their villages where game and fishes were most abundant. The gardens were small and the variety of vegetables they raised was very meagre. Maize was grown by all of them and from the above time to the first settlements of Virginia and to the landing of the Pilgrims in 1620 very little progress was made in the science of agriculture. When the lands became impoverished they were abandoned. Artificial fertilizers were comparatively unknown until the commencement of this century. During the last two hundred years the lands in the older states of our Union have been absolutely worked out in many places, especially Virginia, and the necessity for returning to the land the substances which had been extracted has been well understood, and for years the great study has been just to know what is deficient in the ground and how it can be most readily and cheaply returned; and the demand for fertilizers has wonderfully increased since 1860 until now there are hundreds of rich firms in different portions of the states, whose whole occupation is the manufacture of manures. As the barn yard excretions were found insufficient in quantity, the making of artificial manure was obligatory and the fitting time has arrived in the natural course of human events, that the farmer who knowing the above facts rejects the aid of science, is the greatest enemy to himself. Every fact or statistic that the husbandman learns in a long life can be printed in a few pages and thence transmitted to posterity, and the information gained is a bundle of scientific facts. The time must soon come when the farmer will analyze the soils on different portions of his lands, and supply the deficiencies with as much ease and certainty as an analysis of a specimen of gold will show its worth, and it is a singular and remarkable provision of nature that the needs of mankind are supplied in the ratio of their requirements. When the wood was becoming scarce in the vicinity of our large towns and cities in colonial times, then Franklin and Charles Thompson (or the Count of Rumford), both born within ten miles of each other, began to study to find more economical ways of using it, and the Franklin stove was invented, being the first one in America. The enormous chimneys and fire-places were greatly reduced in size, requiring very much less consumption of wood for the same amount of heat. Then when wood became still more expensive God in his providence directed the attention of man to the immense beds of anthracite coals, and in 1825 it was just being produced, while in the year 1882 the state of Pennsylvania alone mined 29,500,000 tons. During the last half of the last century the people were demanding a better light than the tallow candle and the dim whale oil lamp and the Argand and other burners were invented, and gas made its first public appearance at the coronation of Napoleon in Paris. Then in 1850, when whale oil was becoming scarce, and the intrepid mariner from New Bedford, Nantucket, Fall River and Fairhaven in Massachusetts, had in their hundreds of (two and three years) cruises in the Atlantic and Pacific ocean absolutely depopulated the waters containing these immense fishes and driven the remnants of the tribe into the Arctic and Antarctic oceans, when some other illuminator became a necessity ingenious men taxed their brains for a substitute, and a score of different materials and lamps were introduced. Burning fluids, phosgene, camphine, pimaric and resin oils, were quite common. In 1856 nineteen millions of gallons of burning fluid was used, made from alcohol and turpentine. As the demand for light still increased, Dr. Porter erected in Conshohocken, Pa., an apparatus to make coal oil from bituminous coal. Then other factories were put up in this state and Kentucky and lots of money invested, and when they were fairly under way and were sanguine of making large fortunes in the newly invested oil called kerosene and other names, some curious individual began boring into the ground in Tidioute, Warren county, Pa., and there found subterranean lakes of coal oil, and since that time billions of gallons have been consumed and thousands of wells bored, and now when millions of bushels of corn and wheat are demanded, where thousands would have been ample in say 1820, and when the played-out lands must be replenished with elements removed in the years of planting, and when the barnyard excretions are necessarily so limited in quantity and when the great study of the farmer is to know what kind of fertilizers he requires

on his lands and how the most cheaply to buy and apply them, and when the artificial manures are costing from \$15 to \$60 a ton, he is often in a quandary to know whether to pay these large prices or abandon the growing of crops. Now when this question has become really serious, the attention of farmers of the United States is directed to nature's deposits of marls and we especially to-night want to call your attention to the inexhaustible beds of greensand marl in King William, Hanover and New Kent counties, Virginia, where over an extent of 200 square miles of territory by convulsions and changes, and upheavals and destructions that only the great Creator can account for, are found millions and billions of tons of greensand marl composed of the remains of quadrupeds, reptiles, fishes, shell and the ordure of animals mixed up with other mineral matter, and vegetable debris containing (en masse) all the required elements to fertilize any and all impoverished lands.

This display of bones, shells, marl, rock, etc, are all from the vicinity of the Pamunkey river, except one specimen. I have brought the upper and lower jaws of a recent shark of about seven feet in length whose teeth as you see are less than three-quarters of an inch long, to compare to this fossil shark's tooth which is eight and a half inches long and five inches wide, that you may judge of the unknown monster to whom it belonged, may be ten thousand or a million of years ago, and to say that he must have been over one hundred feet in length, and this bone called the atlas, being the first of the cervical vertebrae of a huge mammoth, was taken out of a deep pit in the marl, and the whole skeleton was over thirty-five feet in length. This bone weighs five and a quarter pounds and measures fifteen inches across the spinous processes.

Fertilizers.

If the reader only knew the exact number of tons of marl, phosphates, ground and barn-yard manures that are annually used in the United States he would be surprised at their magnitude.

The South Carolina developments are of comparatively recent origin, and yet in 1871 the exports of phosphates were 359,000 tons. The United States Geological Survey for 1882 says, that \$540,000 worth of marl was sold by the various companies of New Jersey, and that the associations of South Carolina interested in the ground fossil bones disposed of \$1,147,837 worth of this antediluvian compound, and as farms and farmers are increasing in number in both the Northern and Southern States, the demand for artificial manures is constantly and steadily increasing. The number of farms in Alabama has doubled since 1865, and the increase in crops has been almost fabulous, and the South are raising oats and other grains and crops which heretofore they have neglected. Georgia uses over 150,000 tons of phosphates annually. One firm who manufacture the phosphates use 20,000 tons annually of animal bones and dried flesh.

Marl in New Jersey.

Extracts from the New Jersey State Board of Agriculture for the year 1876, page 13: "There are \$3,000,000 worth of super-phosphates made in this State every year, and 300,000 tons of marl are annually used. Land in New Jersey is rated higher for agricultural purposes than any other State in the Union."

"Over 1,000 square miles are underlaid with some variety of marl. The Pemberton Marl Company dig through 3 feet of gray marl, 11 feet of black marl, 8 feet of green marl and thin chocolate marl. The greensand marl has been often analyzed and varies in its composition:

ANALYSIS OF IT.

"Silica	38,500
Protoxide of Iron	4,260
Peroxide of Iron	20,967
Alumina	6,404
Lime	1,069
Magnesia	2,136
Potash	8,190
Sulphuric Acid	0,343
Phosphoric Acid	1,153
Quartz and water	7,700

Page 101: "The marl has been of incalculable value to New Jersey. It has raised land from the lowest to a high state of improvement. Bare sands are made to grow clover and then crops of corn, potatoes and wheat. Pine barrens are made into fruitful farms."

Gordon's History of New Jersey says: "It would be difficult to calculate the advantages which the state has gained from its marl. It has saved some districts from depopulation."

The book is full of similar statistics.

William V. Conover, of Red Bank, says: "I have improved land that was so poor you could not raise anything on it, so it would cut two tons of hay to the acre. I have used marl for forty years."

New Jersey's Capital—What a Harrisburger Learned upon a Visit There.

Special Correspondence of the PATRIOT.

MOUNT HOLLY, N J., Sept. 26.—"The state of New Jersey has set the state of Pennsylvania a good example, which she ought to follow. This morning I spent some hours in examining exhibits of the soils—cereals, kinds of trees, metals, clays, marls, fossils, minerals and other products of this state, all excellently shown in cases and jars in the state house at Trenton. In a few hours you can thus become partially acquainted with the history of the state. A section of a cedar three feet in diameter, white and colored clays, for which this state is famous. There are twenty-three potteries at the capital. This city was made memorable as the place where George Washington by his strategy, courage and executive ability overcame the English army and took captive several thousand Hessians. The city was named from Judge William Trent, in 1719; then it was a little borough—now a beautiful city of nearly 61,000 inhabitants. The main streets are wide, rows of shade trees on each side and a very large number of first-class three and four-story brick and stone houses, and then really magnificent estates of one to six acres, with mansions set back from 50 to 200 feet, and lawns in front full of tropical plants. On the site of a division fence, perhaps 200 feet long, there was nothing but scarlet sage in blossom. These estates represents \$50,000 to \$200,000 of valuation. The Delaware river is on one side of the city, the Raritan canal runs directly through it. In the spacious room in the capital set apart for the exhibits and entitled the Bureau of statistics, are fossil foot prints of an extinct bird whose three toed tracks are fifteen inches long, also fossil fishes, the tooth of a mastodon seven inches long, the enamel as perfect as when in the attitude of eating, perhaps a million years ago. As you know there is several very valuable zinc mines in the state. Specimens weighing 500 pounds are on exhibition, also specimens of rose crystal marble from Warren county, kaolin, asbestos, slate and other minerals, and over 200 quart glass jars with marls from various portions of the state, and named from their colors, red, gray, black, chocolate, ash, blue and green marl, also clay and sand marls. It is found over an area of 1,200 square miles of extent, and it has been of such decided advantage as to have raised worthless lands to be extremely valuable for farming purposes. The state has made appropriations, and the state geologist has given the subject of marls and their uses to farmers a very large share of his attention. This afternoon I visited the extensive deposits in Birmingham, five miles from Mt. Holly, the property of Mr. Judson Gaskill, whose father was one of the pioneers in introducing the marl to the notice of farmers. Here I found a bank of marl with about one thousand feet of frontage, with a rail along the whole course. The marl is within four to eight feet of the surface and is twenty-five feet in depth, overlying another variety called the "chocolate," which is not used. He is sending away from ten to twenty car loads a week, each car containing from ten to twenty tons. He sold over 1,600 tons of marl in 1882, and is increasing his sales every year. His father began mining and selling it in small quantities in 1818. In 1833 it was worked on a larger scale, and in 1865 a company of wealthy men, with a capital of \$300,000 began working it on a still larger scale. It is shoveled from the banks without any preparation into the cars and then sold to the farmers. Antediluvian remains of bones, sharks' teeth, etc., are found in it occasionally, and sometimes twenty feet from the surface large blocks of wood in the shape of charcoal. The gentlemanly clerk of the Bureau of statistics, Mr. William J. Miley, kindly gave me any information he could concerning the exhibits.—C. A. GREENE, M. D.

Remember.

that there are billions of tons of the greensand marl on the banks of the Pamunkey river more accessible than any marl ever before known in this country. It can be shoveled from its banks into barges, steamboats or vessels as easily as you can shovel in common sand. Remember that every farmer in the United States is compelled to use some kind of a fertilizer to continue the procuring of his crops. Remember that this greensand marl can be carried by above barges and vessels hundreds of miles at from one to two dollars a ton, and that every ton so delivered will pay at least \$1 profit to the company who dispose of it, and that no other manure or composic can compete with

us in the price. That greensand marl can be delivered in Philadelphia, Baltimore, Richmond, Savannah, Ga., Wilmington, N. C., and New York city for less than \$5 a ton at a decided profit, or anywhere else on the Atlantic coast, within 350 miles from the deposits, at the same price, and that one hundred barges a day can load on one of the leases, and that the marl in one of the leases could not be removed by one hundred barges in two hundred and fifty years, then you will begin to appreciate the magnitude of these antediluvian, and perhaps pre-Adamite remains of fishes, shells, reptiles, quadrupeds and bipeds which, millions of years ago, were enjoying themselves according to their separate and especial desires, and then in some incomprehensible manner were brought together by some convulsion, upheavals, or some other way, by the fiat of God, and how, to the Divine only known, were then slowly fossilized and disintegrated, and have been patiently awaiting the allotted time to arrive in the history of the world to be removed from their immense *charnel* beds and carried over the world as curiosities, and to be deposited on hundreds and thousands of farms to aid the sturdy yeoman in the development of cotton, sugar, rice and cabbages for the benefit of the living everywhere, and when puny man in his insignificance looks at these marvels of nature, or artifice, he stands back aghast and stultified, and ceases any efforts to unravel the mystery. It has been my good fortune to have been for half a century a gatherer of geological, conchological and paleontological specimens and curiosities of any and all kinds, and I have to-day a very large collection for a private individual, hence claim a medium right to briefly expatiate on these wondrous works. In 1859, finding that the streets of Cincinnati were paved with antediluvian fossils and that the banks of the Ohio river was composed of limestone full of encrinites, and trilobites and fossils innumerable, and that over a score of fresh water shells, some weighing pounds, were alive in its water, belonging to the class of unios and clasmidonta's, I went among the 250,000 people to find some of the lovers of nature, and was fortunate enough to come in contact with perhaps half a hundred, and called them together in Gundry's college, an organization was effected, and I was appointed president and Dr. Shaler, of Covington, Kentucky, my secretary. This was the second National Historical Society of Cincinnati, Ohio. The first had only an ephemeral existence. One of my officers, Prof. Anthony, was soon after taken to Cambridge by Prof. Agassiz, and was for years, until his death, the principal conchologist to the great museum. My secretary, Prof. Shaler, took Prof. Agassiz's place at his death.

Marl, or Glauconite.

My attention was first called to the above substance in 1853, when I visited the marl beds of New Jersey and soon after I had the pleasure of lecturing on fertilizers before a farmer's club in Philadelphia, and I made strenuous efforts to organize a company to work these deposits, but the fitting time had not arrived. Since that time many companies have been organized and untold quantities of marl have been taken out and sold. One of my correspondents, viz: J. C. Gaskill, of Birmingham, N. J., writes me, April 11, 1883: "Two of us originated the first company seventeen years since, and worked and sold marl from the beds. It was called (as now) the Pemberton Marl Company. Have sold an immense quantity." I think investigation will prove that the greensand marl on the Pamunkey river contains fertilizing agencies superior to any other known deposits, and as no bottom has as yet been found in the Virginia beds, notwithstanding they have dug 70 and 80 feet in depth, and as it extends over an area of at least 200 square miles, the reader can readily comprehend that it is, and will be for hundreds of years, inexhaustible. On the Pamunkey it is found in solid body from 5 to 60 feet above the surface of the water, and can be shovelled into flat-boats as easily as any dirt, and can be delivered in Baltimore for \$3 a ton at a decided profit, and 500 barges can load at the same time, with no annoyance whatever; whereas, the New Jersey marls are inland, and hence could only be delivered by carts, wagons, or by rail. The Pamunkey is some 50 miles long and rises in the Blue Ridge mountains, and is navigable for 35 miles for vessels drawing six feet of water, and can be easily deepened to twice that depth. It ebbs and flows with each tide, although fresh water, and rises and falls some three to four feet. We have at least fifteen miles of these deposits on this river.

Take Especial Notice.

- Briefly, the decided advantages of using the greensand marl are—
- First. It is cheaper than all other fertilizers.
 - Second. It acts favorably on all soils, either clay, sandy or loamy.
 - Third. It contains nearly all the constituents that are constantly being removed by all crops.
 - Fourth. It will continue (unlike barn-yard manure) its good effects for many years, variable according to the state of land.

Fifth. In consequence of its affinity for moisture, it keeps the crops in good dark green growing condition in a dry season, when surrounding crops, not marled, die and dry out.

Sixth. When the land has been limed to death and will yield no crops, the application of say 250 bushels to the acre, will make it fruitful the first year, and its beneficial effects will show more advantageously at every year up to the third and fourth year, when it will hold its own for a dozen years, with no additional fertilizing.

Marl—Its Definition.

The question has been asked of me a score of times, What is marl, and how came it deposited as you describe? The first question I will answer to the best of my ability. The second is only known to the Divinity. The American Cyclopaedia says: "Marl is a clay containing a large proportion of carbonate of lime, sometimes 40 and 50 per cent., and sometimes the relics of shells." Johnson's New Cyclopaedia says: "Marl is a name vaguely applied to those soils and earths which contain a mixture of clay and sand, with a considerable proportion of carbonate of lime." And it further says that the greensand marl of New Jersey is valuable from the presence of phosphate of lime and potash; and also that there is in Canada West (Ontario) a white marl. Chambers' Encyclopedia says: "Marl is a mixture (naturally existing) of clay and carbonate of lime. Marl soils are in general of great natural fertility, and it is very advantageously used as a manure, acting both chemically and mechanically. It has been known from ancient times. An English statute of 1225 gave every man the right to sink a marl pit on his own grounds. Bituminous marl is found in Germany." Noah Webster says: "Marl is a mixed earthy substance, consisting of carbonate of lime, clay and silicious sand in very variable proportions." The Standard Dictionary says: "Marl is a fat earth, containing carbonate of lime." Lyman Cobb's Lexicon says: "Marl is a sort of fat clay, or manure."

The London Imperial Dictionary says, "The name (marl) is erroneously used for soils, containing no lime, Appleton's Cyclopaedia says, marl is little known in the United States, except in New Jersey." The truth is that marl is found in probably one-half of the states of the Union. This erroneous declaration of Appleton's reminds me of a few lines written by the author many years ago, viz :

"Geology is an uncertain science, and books on the subject are made up from supposed known facts, new discoveries necessitate the making of new theories and new works on the subject, changing from year to year."

"Marl has been used in Europe since the earliest known ideas of Rome," so says Bell's Cyclopaedia.

Bell also says :

"It has been demonstrated by practical tests that it is as active and lasting fertilizer as the best super-phosphates, and an ammoniated greensand marl can be easily made, which is equal in value to Coe's, Phillip's or Baugh's best phosphates of lime at less than one quarter of the cost to the farmer."

An old adage says :

"Who marls sand shall buy the land ;
Who marls clay throws all away."

These two lines positively indicate that the ancients knew the difference between shell and greensand marl. In a work of 450 pages on artificial manures, written by William Crooke, of London, there is no mention whatever of marl.

Page 188, of Geology of N. C , for 1875, says: "*The discovery of a greensand marl bed is an event of more importance than that of a gold or copper mine.*" Page 189, says, "The amount of greensand marl is very small in our state, although the shell marl is very abundant."

Now I take exceptions to the various definitions, especially to that portion of Chambers where he says, "naturally existing." All marls are produced. A true definition of the vast manurial deposits of Virginia would be the following: Greensand marl is a composite fertilizer, made up in ages past from the remains of billions of shells, fishes, reptiles, birds, quadrupeds and man in a state of decomposition, and disintegration, with carbonate, sulphate and phosphate of lime, potash, charcoal, silica, iron, quartz, kaolin, and other substances of an oleaginous nature.

Millions of years since the innumerable mastodons, saurians, elephants, deer, horses, sharks and other organic remains which now are found in these deposits, where roving about

the land and swimming in the ocean waters, and after enjoying their allotted leases of life, they died and in some incomprehensible manner were deposited in above localities, then fossilized.

Marl was first known in Monmouth county, N. J. in 1768, by a farmer who was digging a well, and he dumped it into the adjoining ground and in the Geological Reports of the state, it is said that the good effects are perceptible now.

Marl Elsewhere.

E. & I. C. Ruffin published a work in 1840 entitled "The Farmers Register," it was printed in Petersburg, Va. It contains many articles upon the subject of calcareous manures. Prof. H. D. Rogers in his Geological Reports of N. J. calls marl the black micaceous sands. Some call it gun powder marl. Prof. Vanuxem found 14 varieties of marl, at Shell Bluff, on the Savannah river in S. C. containing from 37 to 93 per cent. of carbonate of lime. Ruffin says, Feb. 3d 1841, a deposit of fossil shells was found in Somerset county, Md., also found in Clairborne county, Ala., also in the James river Va. at Cogging Point, also small deposits in Woodstock, Vt. two to seven feet in thickness. Ed F. Wickham, used the Pamunkey river marl in 1824 with great advantage. He also says *my stable manure was much improved by dumping it on dry marl, and afterwards mixing it, it retained all the ammonia and other salts, my increase in crops was over 100 per cent. on 500 acres of land.* Capt. Drury, of King William co., says the same in 1840. Richard Hill speaks of it in the highest terms in 1814, obtained from the Pamunkey. The gray marl in James river was used as a fertilizer in 1776.

Fortunate.

After securing nearly all of the available frontage of all the marl on the Pamunkey river in the purchase and lease of between 2000 and 5000 acres. I was agreeably surprised on reaching Richmond to learn that some 4000 miles of the railroads near the Atlantic Ocean from Louisiana and the Mississippi river to West Point (which is the terminus of the Pamunkey river, and is one of the finest harbors on the coast, never freezing up in mid-winter, and with water deep enough to float the Great Eastern), had been purchased by a Syndicate, and that West Point was destined to become a city, and the Great Atlantic outlet for the vast quantities of corn, cotton, tobacco, rice and sugar grown in the above localities.

I saw many Virginians who had tested the artificial phosphates and guanos, costing from \$12 to \$50 a ton, and who unhesitatingly declared that the marl was superior for two reasons; it lasted for years with no renewal, and it gave better results. I shall propose to the first organized company to furnish enough marl for five acres, to responsible farmers anywhere, who will pay the nominal sum of the cartage provided they will give the increased crops on the five acres for three years.

During my brief sojourn in Virginia I had the extreme pleasure of meeting some of its most distinguished citizens, and among them all I found the same courteous, candid, gentlemanly manners (with one exception), and this one may have been suffering from some intestinal trouble. Among the number was the mayor of Richmond, Hon W. C. Carrington, who manifested the utmost interest in any measure tending to increase the population of Virginia, or develope its wonderful treasures. I also met Judge B. W. Lacy, of Richmond, who is greatly interested upon the subject of fertilizers in general and the greensand marl in particular, which he has successfully tested upon his farm at Tunstall, in King William county. I also saw Mr. E. B. Moon, publisher of the Virginia Real Estate Index, at Richmond, and he informed me that he was selling a good many farms to Northern farmers, and that he would gladly publish anything I might write to aid in getting the marl deposits of Virginia properly worked, and further, offered to take \$1,000 worth of marl and pay for the same in advertising. Mr. Orin L. Cotrill and Capt. C. M. Wallace, of Richmond, Va., have both signified their willingness (by letter) to aid me in developing the mineral wealth of Virginia. So did Hon. John S. Barbour, of Alexandria, Va., whom I met on the cars. I also met Col. W. W. Gordon, of Richmond, who spoke in the highest terms of the marl, which he had used for twenty years.

Thirty years ago the total value of the Southern crops of cotton, tobacco, rice, hay, hemp and sugar was \$138,605,723. The census of 1880 makes it \$760,000,000, and its northern outlet on the Atlantic coast is going to be largely West Point. Within four years 9,500 acres of land at and near Charlemont, Va., on the James river, have been sold to farmers from the North and West. The largest purchases have been plots of 300 acres, and the smallest 20. The new settlers express themselves as delighted with their new possessions.

West Point, Virginia.

ITS WHARF FACILITIES AND RAILROAD AND STEAMBOAT BUSINESS—THE FERTILIZER TRADE—
PROTECTION AGAINST FIRE—IMPROVEMENTS.

[Baltimore American.]

Landing at West Point the visitor is at once struck with the immense terminal facilities there. Along the river front, pier after pier, shed after shed, are seen, in all fully 3,500 feet of water-front wharfage, and with the sheds and platforms, thousands upon thousands of square feet of floor space. Three steamers at one time can load and unload on the new Baltimore pier alone; three or four at the Fertilizer pier, and probably six or eight at the long compress piers. In fact, the landing capacity is equal to that of the Lightstreet wharves. The wharf at which the boat landed on Saturday consists of one solid pier 1,100 feet long by 150 feet wide, not counting the outside platforms, and which, with the exception of about 300 feet, left open as one of the securities against fire, is all under roof. From the lower end of this pier runs another—the cotton compress pier—400 feet in length and 100 in width. Here is located the immense cotton compress of the Morse pattern, which has a capacity of turning out sixty bales of cotton per hour—a bale a minute. Passing again to the upper end of the pier first named, another and entirely new pier and shed is seen, which was built for and to be exclusively used by the Baltimore trade. This pier and shed is probably one of the largest and finest in the country. It ends on the shore, and is in dimensions 405x155 feet, containing 62,775 square feet of floor space. The shed, which is thirty feet under the eaves, is built with a monitor roof, and resembles the great Boston Coliseum of Peace Jubilee times in appearance. Down the centre for almost the entire length extends a double track, thus enabling two trains of cars to load at the same time, one from either side. These building and wharves, so far named, are all for the general business of the Richmond and Danville system. About them all, and enabling cars to be loaded from any point, are lines of track extending in all directions, and connecting a short distance away with the main track. The usual buildings for offices, etc., are conveniently located.

THE FERTILIZER WHARF.

Continuing the tour of inspection, the next place visited, and the most interesting, perhaps, to Baltimoreans, was the fertilizer pier, where it is claimed, exists the most perfect system known for handling fertilizers. The pier itself is 600 feet in length by 130 feet in width. Upon it is built the fertilizer shed, or storehouse, which is 450 feet in length by 75 feet in width, and probably 25 feet under the eaves. Extending over the wharf, from the water end to and within the shed for its entire length, is an elevated platform and railway, similar to the coal elevators now in use on the water-front, for the unloading of fertilizers in bulk. In unloading, buckets handled by steam are used, which elevates the fertilizers to the platform and dumps it into cars of two-tons capacity each. When filled the cars are whirled around the elevator track into the storehouse and there dumped into the proper receptacle. The shed is divided into compartments of about 1,000 tons capacity each, the large manufacturers having one or more compartments, as their trade demands. It was found that all the Baltimore firms were represented. The elevated road is used exclusively for fertilizers in bulk. When shipped in bags the vessels can lie alongside the wharf and unload directly into the cars, which can run up to and alongside of the entire length of the pier on both sides of the shed. A feature of the handling in bulk, and an excellent provision for the manufacturer, is that he can send along a cargo of fertilizer, which the company stores in one of the compartments, and on receipt of an order for so many tons to such a point the company bags the material and forwards it to its destination. The total capacity of the storehouse is from 10,000 to 12,000 tons at one time. Last year the Richmond and Danville handled about 30,000 tons, and expects to double it the present season. The company is now talking of erecting two more piers and storehouses similar to the one above described for the fertilizer trade.

PROTECTION AGAINST FIRE.

An important improvement made at West Point since the last disastrous fire, in 1880, is the introduction of a fire service and a system of electric lighting, both of which are models in their way. For lighting the wharves and other property thirty-one electric lights are now in use, which are run by a thirty-five horse power engine. For the fire service they have a powerful Worthington force pump capable of throwing an immense stream of water, and also numerous hydrants and cisterns, scattered here and there, where deemed necessary. There is an alarm whistle connected with the engine-house, which

can be blown by an electric system similar to that used in hotels, from different points on the piers. The employees of the line at West Point—about four hundred in number—are drilled as a fire brigade, as are also the boat hands of the York river steamers. To show the efficiency of the latter, Captain Jones on Saturday called them without warning to a test-alarm. In less than half a minute the deck hose was in readiness throwing water, and in less than one minute three boats were lowered from the davits, the crews in, and ready for service in saving life.

THE CITY OF WEST POINT.

Since West Point aspires to the dignity of a mayor and council, it is not, perhaps, out of place to call it a city—although its population is less than a thousand. The location is a pleasant one, lying as it does between the Pamunkey and Mattaponi (pronounced *Mat-ta-po-nigh*) rivers, which, here uniting, form the York river. There is one principal street and several cross-streets, the plan of the town being very regular. One thing in particular was noticed in passing through the city, and that was the unusual air of comfort—and at times, even luxury—pervading the entire place. Not a sign of poverty was anywhere noticeable. There are quite a number of new buildings now being put up, and also a new Protestant Episcopal church. When this is finished there will be three churches in the place.

Marl Again.

Mr. C. H. Boud, superintendent of the marl works at Farmingdale, N. J., says that the marl was known in 1823, and occasionally used by neighboring farmers; that in 1868 a company was formed, since which time it has been worked very extensively. Over twelve acres has been dug out and carried away to an average depth of thirty feet. Mr. Boud gave me a great amount of very interesting detail concerning the working of the deposit and other matter of great interest. About 1823; his father, Hugh Boud, found the deposit now worked by the Freehold and Squantum Company. A train of cars runs at the bottom of the excavation and the marl, 25 feet deep, is taken off, leaving the bank almost perpendicular. A body of marl 18 feet long, 8 feet wide and 14 feet deep, contains about 150 tons. Twenty bushels weigh about one ton, and each bushel weighs about 100 pounds. They sell about 2,000 tons a month, mostly to farmers in their own State.

Certificate.

Dr. William B. Croxten, of Manquin, Va., says that George M. Bassett marled his land in patches in 1863, and you can plainly see the difference now, and he has never re-marled the same land. Dr. Croxten says he is now getting 250 bushels of corn to the acre by marling, when he could not before obtain ten bushels. A patch covered with thistles for years was entirely killed by marling, and he now cuts some years two tons of clover per acre. He has been down in his marl pits 80 feet and found no bottom. Mr. Hogan says: I obtain 23 bushels of wheat from my marled land, and ten only when I have not added the greensand marl.

Another.

John C. Lacey, of King William county, Va., told me that he bought a farm in 1868 that was worn out and by marling he has so enriched it that he raises elegant crops, and that he does not use his stable manure. He considers the marl more valuable, and it retains its virtues for so many years, when stable manure must be replenished annually. Dr. John T. Lewis and Dr. Thos. Custer, and many other reliable farmers, made similar statements, after testing the marl for from 10 to 35 years.

Marl, Where Found.

I met on the cars, when returning from Richmond, I. C. Washington, of Kingston, N. C., who says that the calcareous marl is found in the Neuse river. He is a relative of Bushrod Washington and of Gen. George Washington.

Beads

Prof. S. S. Haldeman, who devoted so much time to prehistoric beads, would be wonderfully excited if he saw two black primitive looking beads, over half an inch long, that I found 20 feet below the surface in a marl deposit in King William county.

Fertilizers.

Over one-third of the population of the United States are farmers and the other two-thirds are dependent upon the first third for their eatables; and no farmer can succeed except by the use of manures, and the whole subject is now in its infancy, hardly two farmers can agree upon what kinds are best for their soils and how and when to apply

them. I have predicted for more than a quarter of a century that the time will arrive when farmers can analyze their soils in different portions of their farms and supply the deficiency with the same ease and certainty, that a chemist could tell the constituents of gun powder. At present we are woefully in the dark.

James J. Carter of Chester county Pa. says in the Agricultural Report of Pennsylvania, page 64: "While I had charge of the Agricultural farm in Chester county, I made several thousand experiments with fertilizers, upon all the crops usually grown on a farm, and in a large majority of cases the fertilizer that was richest in soluble phosphate of lime gave the best results, and the fertilizer that did best for corn was likely to do the best for all other crops." Now I claim that if anyone interested will visit the lands in King William county Va. where the marls have been applied and where they have not, he will find this distinct difference, where the marl has been applied to worn-out lands with about 250 bushels to the acre, that year after year (with no other manure or replenishment), abundant crops of corn, clover, peas etc., are harvested and where it has not been used, only a half crop is made. I saw one hundred acres of corn which would average eleven feet high and four to five ears to each stock, marled, and in adjoining fields, with same variety of soil and no marl, scraggy looking corn grew five and six feet high and light green color. I saw an inland deposit where the marl had been used for years, the walls were thirty feet high of solid marl and 300 feet long, I saw some 200 tons of oyster shells on a farm placed there in 1859 which had been purchased to grind up and place on the farm, and in consequence of the discovery of marl there, they now lay unused. There are three kind of soils in King William and Hanover counties, red earth, clay and sand, and the marl shows the same results on all. The farmers of Pennsylvania, I have found divided as regards the beneficial results of marl and the reason why they are unsettled is that one has tried a poor marl and another a rich marl, and it varies like the quality of apples. The white marl is calcareous, and nearly all carbonate of lime, the gray differs somewhat. The Florida marl and the marl found in Canada and on the Neuse river in N. C. are no better than common burned lime stone, but the greensand marl of Va. is a horse of another color and value.

Manures.

If you propose to build a house you first select the lot, then buy the various materials necessary to make a complete domicile. The bricks, mortar, floor and other boards, shutters, windows, sills, lock, keys, hinges, etc., have each their especial locality and part to fulfil. Just so it is in the formation of a tree or plant. Certain elements are positively essential, and if these ingredients are not in the soil your ploughing, planting and hoeing are all futile. Putty is composed of certain parts of whiting and linseed oil. Now you may experiment until the end of all things and you cannot make putty without you use the above simples. More than that, the ingredients must be mixed in certain proportions. The laws of chemistry are positive and never change. The successful baker is the one who puts his flour, yeast, salt and water together after well known receipts. He cannot throw the salt, flour, water, etc., together without any reference to the rules. Poor bread is always the result of a lack of this knowledge. Now the sooner the farmer comes to this conclusion the quicker he will farm advantageously, profitably and with pleasure. An analysis of the soils must tell their component parts. If they lack carbonate, sulphate or phosphate of lime in order to grow your contemplated crop, you must supply the demand or your labor will be thrown away. I have clipped a few newspaper articles to prove these statements:

"An analysis of 2,000 specimens of wheat made by Professor Richardson, of the Department of Agriculture, leads him to the conclusion that the soils of the Atlantic coast have been more or less worn out; that the middle West is losing its fertility, and that only in the far West are to be found the plant food and nitrogen which make the richest wheat. The Eastern wheats are found by Professor Richardson to be deficient in quality and size; the wheats of the Pacific coast are of full size, but the quality is far below the standard. The value of these extensive examinations is the indication given to the wheat grower, who has not time to improve the soil, as to the locality of the best wheat growing belt; the warning it conveys to the farmers of the East and middle West as to the necessity of a liberal use of fertilizers and the clue it gives to all wheat growers to the localities that produce the best seed wheat."

Another.

"In the last report of the Scottish Horticultural Association is a paper on the analysis of soils, taken from the vineyards in which the crops have failed. Comparing the constituents with those of soils upon which grapes have been successfully grown, it appears that there is a deficiency of lime and potash in the unproductive vineyards."

Another.

"Four thousand pounds of apples, when reduced to ashes, will weigh about 100 pounds, which contain thirteen pounds of potash, twenty-five ounces of soda, and a little lime, iron and magnesia."

Another.

"Sand contains no fertilizing properties to any extent, excepting potash, which is in the form of silicate of potash; but the action of the decomposition of these fertilizers which are very rich in nitrogenous matters liberates or makes soluble the potash, or a part of it, so that it becomes a very good fertilizer for all crops."

Phosphates and Potash.

"Phosphate of lime is only one of the mineral fertilizers upon which plants delight to feed, but which continual cropping, without returns, will soon exhaust. Potash, upon which plants make large demands, is another. Grass and potatoes may be called potash plants, because, containing a large per cent. of this mineral. One hundred parts of dry hay will leave, when burned, nine per cent. of ash, which the largest part is potash. Successive crops of grass must, therefore, exhaust the land of this, its leading constituent, unless it is returned in some shape. Just what mineral fertilizers grass lands want in order to keep them in good productive condition may be learned from the following statement of that eminent scientist, Bousingault: 'Ten thousand pounds of good meadow hay contain 547 pounds of inorganic (mineral) matter, of which 130 pounds are potash, soda, 10 pounds; lime, 107; magnesia, 43; oxide of iron, 5; silica, 189; sulphuric acid, 16; phosphoric acid, 32; and chlorine, 15. While many of these are found in almost inexhaustible quantity in all tillable land, potash, lime, sulphuric and phosphoric acids diminish rapidly under cultivation, unless returned in some way. It is a suicidal policy, therefore, to neglect the application of these mineral fertilizers on land severely cropped. Nor has any fertilizer a more permanent effect on such land than wood ashes.'

Another.

"Potash is one of the most necessary ingredients of the soil for plant food. It is at the same time very abundant in the soil, but unfortunately is held in its combination with silica, in the form of a silicate, in an insoluble and inert condition; and therefore it is that an application of potash, in whatever form it may be, to the soil has such remarkably favorable effects. It is because of their effects upon the soil in rendering the potash available by dissolving the silicate that lime, salt, chloride of potash, and perhaps gypsum, or the sulphuric acid released from this in its decomposition, are so beneficially used as fertilizers; and it is this effect, also exerted by the atmosphere and the weather upon the silicates in the soil, that makes fall plowing, fallowing and cultivation of so much use. The abundance of potash that exists in the soil may be realized by considering the proportions of it which go to make up the following common rocks and minerals which enter into the composition of rocks. Mica, the glistening, scaly substance that is so abundant in almost every soil, and in a great many rocks, contains nine per cent., of potash, feldspar, (the flesh color and reddish rock which is so often associated with quartz in granite, gneiss, mica, slates, porphyry and basalt, and is often found in masses and veins alone,) contains no less than 17 per cent. of potash, and nearly all the slates contain a considerable portion. As these rocks form more or less of nearly all soils, clays, loams, gravels and sands, potash is therefore exceedingly abundant; but, as we have said, it is so locked up as to be only slowly available. But as it becomes available it is held very firmly in the soil, and is never carried off by the drainage. A farmer can never, therefore, go wrong in liberally supplying his soil with potash."—*The Dairy*.

Another writer says he is inclined to believe sulphur a very important factor, being equal in value, if not superior, to phosphoric acid.

Sulphur exists in certain proportions in all soils, but chemists have been unable to discover that it performs any important service as plant food.

Causes of Decay.

Innumerable rivers, streams and springs are perpetually loosening the soil, rasping down the rocks with sand, and bearing off billicns of tons of solid matter to the sea-bottom, where the whole mass is squeezed with terrific hydraulic pressure into stone, marble or solid strata of some kind. The Mississippi alone carries annually to the sea 812,500,000,000 pounds of mud. All the habitable land of the globe is being continually ground and washed away—planed down to the ocean-level; while the sea-bottom is being as steadily filled up. The deposit of foraminiferal shells alone—not including other remains—is sufficient, as Huxley has calculated, to create a bed of limestone in the bottom of the Atlantic and Pacific Oceans 800 feet thick, supposing these oceans to have existed for only 100,000 years.

Adulteration of Phosphates.

BY B. F. HALL OF SHERMANSDALE.

In looking over the "Tabulated Analysis of Fertilizers" as furnished me by the State chemist (Dr. F. A. Geuth), I find that he has already analyzed 314 different samples. In that number there were 99 which had no potassa, and 45 no ammonia; hence these are called incomplete manures, and partake more of the nature of stimulants. Take, for instance, the South Carolina rock which has entered so largely into the composition of many of the fertilizers, and the amount available is from 200 to 300 pounds per ton. Here then, we have 1700 pounds which are useless and worthless both as to soil and plant. To give the reader an idea how some phosphates are made, I will suggest the following, viz: Take 1 ton of South Carolina rock, containing 200 pounds of phosphoric acid—122 pounds of this is soluble and reverted, and 78 pounds are insoluble. Then we will add 20 pounds of potash and 25 pounds of ammonia. In tabular form:

122 pounds phosphoric acid soluble and reverted at 10cts. per pound,	\$12 20
78 pounds phosphoric acid insoluble and reverted at 4cts. per pound,	3 12
20 pounds potash at 6cts. per pound,	1 20
25 pounds ammonia at 17½cts. per pound,	4 37
Total	\$20 89

Here now we have a ton of phosphate worth \$20.89 the same article being sold in market at from \$35 to \$40; but we must not forget that we are handling 1700 pounds of rock which is entirely worthless. And what is true in the foregoing statement in reference to this rock, is true of it wherever it is found. In the list No. 303 I find a fertilizer which has but 6 pounds of insoluble phosphoric acid, worth 37 cents, and 24 pounds of potash worth 14 cents, and two pounds of ammonia worth 17½ cents per pound, making in all 86 cents, and yet this fertilizer is selling in the market at \$15, and farmers are buying it because it is cheap. This phosphate has but 10 pounds of plant food in a ton. What the 1990 pounds are made up of I won't tell you, because I don't know. Then there is another fertilizer calculated in the same way with but \$5.05 and is being sold at \$20. And another still worth but \$26.27, and is being sold at \$40. Some of these very phosphates have been introduced into this country and sold pretty extensively. We will now look at some of the fertilizers made out of bone and animal offal. In some of these we have as much as 40 per cent. of bone, capable of producing:

230 pounds of soluble and reverted phosphoric acid at 10cts. per pound,	\$23 00
Insoluble phosphoric acid, 25 pounds at 6cts. per pound (it being bone),	1 50
Potash, 90 pounds at 6 cts. per pound,	5 40
Ammonia, 80 pounds at 17½cts. per pound,	14 00
Total,	\$43 90

This phosphate, and a number of like import, are being sold at \$40 and less. Dr. Gueth tells me to select no phosphate, where the selling price exceeds the estimated or commercial value, for he has counted the ingredients at retail prices. Again, there is this difference in bone phosphate, and phosphate made up of something else, for after the available portion (and this is all the chemist gives) of a ton is but given as above, the residue is deposited with it in the soil, and like the decomposition of vegetable matter it becomes soluble in the course of time and will last for years. Its effects are very manifest where it has been used 10 or 12 years. For example let us take a load of manure of 3 tons weight and we have about 3980 pounds of matter and 2020 pounds of dry matter, capable of producing 11 5 pounds of phosphoric acid, 30 pounds of potash and 24 pounds of nitrogen, equal to 20 pounds of ammonia. By putting 4 loads on an acre of ground we would have just four times this amount, viz: 12 tons of manure containing 46 pounds of phosphoric acid, 120 pounds potash, and 80 pounds of ammonia. Now I will take up a super-phosphate made up of bone and animal offal, and put the following on another acre of ground, viz: 26 pounds of soluble and reverted phosphoric acid, 16 pounds of insoluble phosphoric acid, 14 pounds of potash, and 11 pounds of ammonia, and I will insure better results both in wheat and clover.

This I have tested now for 6 years, and I know whereof I speak, and I am satisfied that it will last longer with the same treatment than manure. Whether it is because of its mineral qualities, or because of its availability, I can not tell, but such has been the case where I tried it.

I once heard of an old lady who had conceived the idea that a pound was a pound—hence she used a tin cup for her scales, counting the full of it a pound. This might do

in "shot and shell," but it would not do so well in "chaff or feathers," and just so it is with some men in regard to fertilizers—a "tinfal is not a tinfal," unless it contains the same ingredients. We should know what we want, or at least what we are getting, and this we can only do by referring to the analysis of all the different kinds of fertilizers as published by the state chemist. And yet there are some people (not many) who say that there is no dependence to be put in the analysis. Chemists cannot tell what these phosphates are made up of. The science of chemistry, whether it be analytical or agricultural, has become so perfect, that the chemist can tell the component parts of any composition. And why not tell what our phosphates are made up of, and their per cent?

The rule laid down by Leibig, Lawes, Volcker and Ville (the best chemists that ever lived) is, therefore to supply the land with more phosphate than the harvests remove and this can only be done by selecting what is styled a perfect manure—one possessing all the elements of "plant life."

Wonderful Increase in Farms.

According to the census bulletin, the number of farms in the United States was 2,600,000 in 1870, and 4,000,000 in 1880.

This vast increase in the number of farms indicates that, first, the demands for the products of farms is augmenting; second, that the number of farmers is of necessity much larger and, lastly that the demand for artificial fertilizers is increasing in the same ratio.

Apology No. 2.

You can easily see that the statistics which are dropped in here and there in this work, are not arranged, no effort has been made by the writer to get up a scientific essay, or prepare the reading matter so as to pass a critical examination by professed book makers, my whole object is to instruct those who peruse these pages, to show:

First.—The necessity of fertilizing the ground when crops are expected.

Second.—That an immense amount of money, and a very large number of individuals and corporations are engaged in the manufacture and sale of fertilizers.

Third.—The enormous demand.

Fourth.—That in the vast deposits of greensand marl in Virginia, you have all the required elements found in all other deposits and fertilizers with a few exceptions. The Virginia marl contains any quantity of black nodules that seem to be nearly pure phosphate of lime, any quantity of bones in a petrified and semi fossilized condition and millions of tons of phosphate rock in among and under the beds of greensand marl.

My examinations running through seven days, up and down the Pamunkey river makes me conclude that so far as phosphate rock is concerned, that there are millions of tons of it. At one locality on the Pamunkey I found under, say 40 feet of marl a regular quarry of phosphate rock of which I have specimens. And in an inland excavation I found tons of phosphate rock that had been thrown to one side as useless, many very large boulders.

In order to give my readers a slight, imperfect idea of the "Sunny South," I will here introduce two letters which I sent to the Harrisburg, Pa., Patriot, while on my brief tour in that favored locality, which must necessarily be (in a few decade of years) the "Garden of Eden" of the United States.

MANQUIN, KING WILLIAM CO., VA. }
August 2d, 1883. }

Here I am, within ten miles of the locality where George Washington was married to Mrs. Custis, in the town of Manquin, King William county, about twenty-four miles from West Point, on the York river, and about two hundred and fifty miles directly south of Harrisburg.

I would ask every inhabitant of Pennsylvania, who has ten dollars to spare for pastime regaining of health, or a desire to see what is unknown in his own state, to take the same trip over the same route, were it not that there is no hotel or boarding-house here. If there was, hundreds and thousands of visitors would flock to this wonderful locality.

I took the cars at Harrisburg at half past four o'clock Wednesday morning for Baltimore, arrived there about nine o'clock, and spent the balance of the day up to four p. m. in seeing Druid park, and other views of that beautiful city. Then I took the steamer Havana, for West Point. The distance from your city to West Point is 275 miles. I reached there at eight o'clock on Thursday morning. The boat is well equipped. State rooms and the table are excellent. The sail down the Chesapeake bay, and up the York river was magnificent. At West Point, which is one of the best harbors on the Atlantic

coast, I took the Richmond cars, and left them at Lester Manor, and there met a Harrisburg born gentleman, Mr. William M. Stehley, who took me in his buggy twelve miles to this extraordinary locality, which is only twenty-two miles from the far-famed city of Richmond.

Mr. Stehley and his courteous sister, Mrs. Catharine Frazer, who are brother and sister of Mrs. Maria Haldeman, and their mother, Mrs. John Stehley, live at No. 9 Front street Harrisburg. Mrs. Frazer owns some 465 acres here, and her farm is called "The Grove." Quite a number of your citizens have been here. John, Robert, Edwin, Mary and Maria Haldeman, Dr. A. Rutherford, Miss Eliza Robinson, the daughter of Rev. Dr. Robinson, are a few of them. The weather is delightful. I am obliged at night to keep the covering over me. Such a thing as sunstroke is unknown to the inhabitants. The sun is no more oppressive in mid-day than in your city. Friday morning the wild mocking bird awoke me. The splendid grove of ancient trees was resonant with the music of the varied songsters. The Pamunkey river runs through this section and is navigable for thirty miles for good sized vessels.

In a boat I sailed up and down some ten miles. It is from 200 to 500 feet wide, and its banks are from five to thirty feet high; and I never saw such a variety of trees, shrubs and foliage, so very rich and dark green in color. It reminds you of the banks of the Amazon. Any quantity of rare wild flowers are seen on its banks. Coral honeysuckle and morning glories will attract your attention—the latter flower some three inches wide. Its banks are impregnated with the fertilizing marl, and its verdure is rank in its richness. The oak, catalpa, hickory, black walnut, holly, locust and other trees grow to most splendid proportions. In my tramping in the woods, I keep constantly finding some new flowers. Jno. Schmidt would get wild if he could see them. Curious cactus, gladiolas, ferns of all varieties and a beautiful flower called "crape myrtle." I cannot describe it. In front of Mrs. Frazer's house is a box tree ten feet high, and near the house stand locust trees literally covered with the English ivy. One vine that looks like a grape, bears a fruit said to be extra delicious, called sloe. The passion flower is quite common in the woods. Fruits of all kinds are very handsome. The persimmon tree is very common.

While riding up from Lester Manor, I was quite surprised to see a long string of colored women, with huge bags on their heads, full of sumach, which they dry and sell to the stores, which again sell it to the tanners.

They walked along quite rapidly, with the heavy burdens balanced on their heads. I am fattening fast on Mrs. Frazer's Southern feed. Cornmeal is cooked in every conceivable style. Mr. Tinker could make a fortune if he would send some one here to get her various receipts for scratch-back, butter, bread, corn cake, &c. The turkey buzzard, a very large bird, is quite common here, and is never killed in consequence of its being so good a scavenger. Whenever any dead animal is thrown into the fields, these birds are attracted for miles distant, and stay near it until all of it is eaten up.

This locality will, in a few years, become widely celebrated in consequence of the inexhaustible deposits of greensand marl, which has been for many years almost the exclusive fertilizer used on the large farms of this historic state. As I shall soon make an exhibition of this marl, and the numerous styles of fossil bones found here, I will not now further dilate upon the subject.

The woods, lakes and rivers here are full of birds. Wild geese and turkeys, ducks, &c, are in great numbers in their season. Quails, pheasants and foxes, and deer are also plenty, but there comes one bird in September that puzzles the naturalist. It is called the sora. It is killed at night in the woods by negroes. It is very fat and delicious eating. No one can tell whence it comes or where it goes, or where it raises its young.

When the first frost makes its appearance, the sora disappears, and they so secretly leave this locality that no one has seen them when making their departure.

Mrs. Frazer has some fig trees which bear luxuriously every year. Grapes grow wild in abundance, of many varieties.

Mr. Stehley has marked one vine that contains extremely large fruit of singular qualities, and I shall get some cuttings for my friends at the proper time. The green grapes on this vine are larger now than most others when ripe. There is any quantity of new things to be seen. The river is full of various kinds of fish, and sturgeons are caught six feet long. Shad and herring come here in great schools at certain seasons of the year.

[Taken from Harrisburg, Pa, *Patriot* of August 9th, 1883.]

RICHMOND, VA., }
 Aug. 6th, 1883. }

I should be eternally glad if seven-eighths of all the inhabitants north of Mason and Dixon's line were compelled to pass at least one month in the company of the citizens of Virginia. Their eyes would be wonderfully opened up on several themes, which to-day are the problems of our great country. I've been in this historic state about one week, and I never met a more congenial, hospitable and better educated set of people in my life. The eleventh commandment of "Love thy neighbor as thy self," is more closely lived up to here, than before known in my experience of half a century, and I have been no idle observer. Every name you meet of the towns or counties, reminds you of the Fatherlands of the people, but especially is old England represented. The very large territory in which the immense deposit of marl is found is called after one of England's sovereigns, King William county. All the old dukes' and lords' and titled baronets' names are attached to some locality. I have had many and many a conversation on the subject of the effects of the abolition of slavery, and the general declarations of those who were the owners of the negro almost universally say the following:—

"No greater injury was ever perpetrated against any people than the destruction of this, our inheritance, thus giving three millions totally uneducated blacks the right of suffrage and freedom."

You are aware that schools for blacks were unknown, until the above political upheaval took place, and all of the whites with whom I have conversed say that the great, and unsolved problem of to-day is: what shall become of the American Ethiopian? And strange as it may seem, to the northerner, they do not socially affiliate to-day any more than oil and water would. To recognize a negro on the street, or to become in any way familiar with them, for instance to sit in the same seat in a car with a colored man and intimately converse with him (if known), would be a barrier to the entrance to good society. In other words, these people have been educated from childhood up, "born in the bone," to believe the blacks to be an inferior race, born for servitude, incapable of achieving the same intellectual heights of the white man, and several generations will be born and pass away before their conceptions will be materially altered. They talk to and of their servants as though they believe sincerely what I have above stated. The quarters of the colored man in all the manors or farms are not as well made as are first-class pig pens in New York.

And upon questioning the negroes who live in them as regards their likes and dislikes, I find them perfectly contented with their menial position. They seem to accept it as a matter of course. A manor is, a huge farm 400 to 2000 acres, and usually designated after some European manor. The coat of arms of some of the English nobility is gladly shown to you, hanging in their parlors as the evidence of descending from good stock. The Virginians of this class are decidedly clannish, and the poor unfortunate white citizen is not their companion. They hire him, but they do not associate with him. The houses of the negro are usually made of slabs or logs, and the interstices filled with mud, rude enough usually with no cellars, and the occupants would say to me: "This is good enough for the nigger." This last word as you are aware, originated from the Latin word *niger* or black. The celebrated legal writer Blackstone signed himself, *Nigris, Lapidis*. The negro quarters are sometimes within two hundred feet of the mansion, and some of them are a quarter of a mile distant, and it utterly surprises me to see the negro women carrying a tub or bucket full of water on their heads from massa's house to their cabins without spilling a drop, and with their arms swinging at their sides, Mr. Beauregard Turner, who lives near Mr. Stehley's, says he has a negro who can carry a watermelon on his head and one under each arm. The conformation of the top of the cranium, is decidedly different in form and structure from the Caucasian.

To-day I visited Libby prison, (the headquarters of General Washington, during the Revolution) and many other objects of decided interest. The very large equestrian statue of Washington in the capitol grounds should be seen by every one who can invest ten dollars in seeing a rare work of art made by the sculptor, Houdon. It was unveiled some twenty years since. The horse then was burnished with gold, all traces of which are now gone. It shows the "Father of Our Country," with an arm outstretched, giving orders to his aids. The statues of other distinguished Virginians surround the monument, among whom are Chief Justice Marshall and Patrick Henry. This afternoon I propose visiting the spot about one mile from my hotel, where Pocahontas rescued Capt. John Smith from her father, Powhatan, and his subjects, also Henry Clay's and Stonewall Jackson's monuments, the bust of Lafayette, tombs of President Monroe, General Lee and Jefferson Davis' mansion and the battlefields around the city. I have seen the confederate monument singularly suggestive of the "Lost Cause." It is about thirty feet high and

pyramidal in shape, made of unhewn rough granite taken out of the James river, which is a portion of the city. The city is abundantly supplied with splendid water from this river and the pumping house and its appurtenances are something like Fairmount. The Exchange hotel, where I am stopping, is a first class house, about as large as two of the Jones house. Two large buildings on each side of the street are connected with a bridge some seventy feet long. The weather here to-day is less warm and uncomfortable than in your city during the last month. Tell all your readers to see Richmond, before they terminate their terrestrial existence.

C. A. GREENE, M. D.

New Jersey Marl.

Prof. Geo. H. Cook, State Geologist, kindly sent me the Reports of N. J. State Board of Agriculture for 1876. It contains a large number of statistics in favor of the use of greensand marl; I will transcribe a few of them; on page 101 it says: "Lands which in the old style of cultivation had to be fallow, by the use of greensand marl, produced heavy crops of clover, and grow rich while resting. *Thousands of acres of land, which had been worn out, and left in common, are now by the use of this fertilizer, yielding crops of the finest quality.*" Instances are pointed out all through the State where the greensand marl has been used, of farms that formerly would not support a family, now are making their owners rich by its use. Lands in southern New Jersey forty years ago were rated very low, now are much higher than in the northern portion of the State where the greensand marl has not been used. The land for farming purposes is higher in price than anywhere else in the United States.

Gordon's History of New Jersey, Part 2d, page 5, of the year 1830, says: "It would be difficult to calculate the advantages which this State has gained, and will yet derive from the use of the greensand marl. It has already saved some districts from depopulation, and increased the inhabitants in others; and may in the future contribute to convert the Sandy Pine deserts into regions of agricultural wealth. [Note. This prediction has been verified.] In Morse's American Geography of 1819, it says of New Jersey: "Four-fifths of the six southern counties, or two-fifths of all the land in the State are barren. They produce little else but scrub oaks and stunted pines. The inhabitants raise a little maize, rye and potatoes, but subsist chiefly by feeding cattle on the salt meadows, and by fishing. [Note. The census of 1870 says that the highest priced lands in the State, and the largest amount of agricultural products is from these same six counties.]

Wm. V. Conover, of Red Bank, Monmouth County, N. J., says: "I have used the greensand marl for fifty years. I find it beneficial to all soils; I use from thirty to one-hundred loads to the acre, I have improved land that was so poor it was worthless, and now I can cut two tons of hay per acre. It will prevent sandy soil from burning the crops, and clay soil from baking, and insure crops on all kinds of land; with barn-yard manure it makes the potato larger and smoother."

I. I. Van Mater of Holmdel, N. J., says: "I have used it for twenty-four years. My grandfather discovered it in 1790. We have used as high as 3000 loads a year. The good effects of the greensand marl have been perceptible on a portion of the farm where it was marled thirty years ago, and none applied since. Barnyard manure soon loses its effects."

All through the above work are similar statements, occasionally a farmer has used some other varieties of marl with little or no advantage.

Certificates.

Mr. A. W. Wileroy who owns a large farm on the banks of the Pamunkey says: "I have seen its good effects for thirty years. I know of land in this county that was very poor made rich in a few years by the application of the greensand marl. Our lands that were barren forty years ago, are by its use now exceedingly fertile. It is the only permanent fertilizer known to farmers in this vicinity. I never heard the first person condemn the greensand marl who had given it a faithful trial."

ANOTHER.

Dr. William V. Croxton, in a letter of August 1883, writes me the following: "I live a mile or so from the river Pamunkey; have been using the greensand marl twelve years, using from 250 to 300 bushels to the acre. I have applied it on some of my poorest soil. The benefit derived was soon apparent, especially after the first clover crop, which was about two tons to the acre. No farmer in this county who has put it on in same quantity to his poorest ground has a shadow of a doubt upon the question of its great value for all our crops; our fields that would not produce five bushels of wheat, now after marling bring me twenty bushels to the acre. I consider greensand marl far superior to stable manure, and I know of lands where its good effects has shown for thirty

years. and what is equally singular, larger quantities than above may be put in each acre without doing any injury whatever."

ANOTHER.

A widow lady by the name of S. C. Trimmer, living also near the above river, says: "My husband thirty years ago, spent a deal of his time carting on the greensand marl to our poor land, and I often gave him a good scolding for thus throwing away his time when we were so poor; but he kept right on carting on the marl whenever he could spare the time. Our land generally was then so poor it would not raise five bushels of corn to the acre. He died about ten years ago, and now we are getting from forty to sixty bushels of shelled corn to the acre in consequence of his marling, and I am now sorry he did not marl the whole farm."

ANOTHER.

Mr. K. D. Hogan in same county writes me: "My father bought the farm I am now living on, of 440 acres, in 1843 for \$2,200. Some years after that time he began applying greensand marl to the land, and put it on nearly half the farm. In 1873 it had so much improved by this wonderful fertilizer that he was offered \$9,000 for it. About 250 bushels were scattered on each acre. One year he sold \$4,900 worth of produce from this farm, and all of the farm to-day that was properly marled, continues to produce all kinds of crops I desire to raise on it. To sum it all up, I think that our greensand marl is the most perfect, and lasting of all known fertilizers."

Marl.

By an Act of the Pennsylvania legislature of June 28th, 1879, the greensand marl of New Jersey was admitted as a manure to the State without any provisions or penalties as provided for all other fertilizers, which was a first-class acknowledgement of its merits. If you will take two peck boxes and fill them with earth from any portion of your farm, and into one box put say a quart of greensand marl and in both of them plant at the same time some oats, millet, and hemp seed; in one month you will see a very decided difference in favor of the one containing greensand marl.

Further Evidences that Impoverished Lands Require Manuring.

Dr. Delmay stated recently that the 480,000,000 bushels of wheat raised in this country in 1880 took from the land 2,800,000 tons of nitrogen, 1,000,000 tons of phosphoric acid and 120,000 tons of potash, and that these quantities were ten times as great as those contained in all the manures used in all the crops in the United States that year. Plainly, here was a heavy draft upon the soil, which is the bank account of our agriculture; The result is already seen in the diminished wheat yield in some of the Western States. that is, less income from a smaller capital. It is even now said that wheat farming does not pay in Missouri, because the average yield of a little more than thirteen bushels per acre will not meet the outlay for the crop. In some States the crop is even lighter. And how did all this come about? The straw and cornstalks were burned up, and even the ashes allowed to blow away, as if it were a crime to return anything to the impoverished soil. It has been said that manure was often allowed to accumulate about barns until it was easier to move the barns away from the manure than the manure from the barns. The throwing away of cotton seeds for years in the South when it could have been returned to the soil with advantage is another flagrant instance of squandered capital. So is the failure to utilize the waste products of manufacturing establishments and thousands of tons of plant food, taken originally from the soil, run to waste every year through the sewers of our cities. The practical lesson from this for every individual farmer is to look forward beyond the money he received in any year and study whether any of it is taken from his capital. Such a course must be disastrous sooner or later. Unless the land is fed it will soon cease to feed him. The principal must be kept whole or growing at all hazard. The best farmers are those who look forward beyond immediate results. We have one man in mind who prepared his ground for wheat and the manure alone cost as much as the grain sold for. But he had doubled his principal, and every year since then this field has yielded a double interest in rich pasturage for his herd of Jersey.—*Philadelphia Press.*

Marl Again.

I want to decidedly impress my readers with these simple facts, that there cannot be found poorer land anywhere than in some parts of King William county, Va., and that if properly marled the same land will bear large crops, and that when the marl comes to or near the surface of the ground, as it does on the banks of the Pamunkey the shrubs, and trees and plants of all kinds grow most luxuriously.

Fertilizers Sold in United States.

I received the following letter from Hon. George B. Loring, United States Commissioner of Agriculture, made out by the statistician Hon. J. R. Dodge.

WASHINGTON, D. C. *December, 28th 1883.*

Sir, the accompanying table is prepared in reply to your letter, containing the following inquiries. What amount of fertilizers were used in the United States in 1882, and what was the amount of money paid for the same. The tenth census shows that \$28,586,397 was paid for fertilizers in the United States, and Territories in 1879 and \$15,967,277 in eleven States as per table attached.

Table showing the quantity and value of commercial fertilizers used in 1882 in the States named:

States.	No. of tons.	Av. price per ton.	Total amt. paid.
Massachusetts.....	16,681	\$35 00	\$583,835
Rhode Island.....	2,000	40 00	80,000
Connecticut.....	21,000	19 86	417,000
New Jersey.....	30,163	35 49	1,070,549
Pennsylvania.....	70,000	30 00	2,100,000
Maryland.....	100,000	36 47	3,646,500
Virginia.....	90,000	33 89	3,050,500
South Carolina.....	113,000	25 60	2,892,687
Alabama.....	77,016	38 54	2,968,070
Tennessee.....	15,000	33 33	500,000
Ohio.....	40,000	37 30	1,492,000
Totals.....	574,860	\$32 71	\$18,801,141
New York.....	75,000		
North Carolina.....	80,000		
Georgia.....	124,000		
Total.....	854,844		

J. R. DODGE,
Statistician.

December 28th, 1883.

In order to still more conclusively show that this world has been broken up and thrown together again—sometimes chaotically—and has been and is now constantly going through a process of formation and destruction, let me introduce the following article from the Reading, Pa., *Eagle*, of Nov. 21st, 1879:

Prehistoric Animal Life.

BY C. A. GREENE, M. D.

The question is often asked, when was this world created, was it formed from new unused material by the fiat of God, or is it made up of the fragments of other worlds? Every man, woman and child that has ever lived must think and our thoughts take singular views and conceptions sometimes. After having considered the above questions for many years, and read up the learned opinions of distinguished geologists and other men upon this subject, my conclusions are that this world has been in existence for millions of years, and has been constantly undergoing a series of changes. To be more particular, there any quantity of facts which show that the earth is like the human body, all the time growing and decaying. Stalagmites and stalactites are forming in caverns wherever they occur. Similar formations can be found under many arches or bridges made of stone; anyone can see them in miniature under any of the stone arches of the bridges used by the Reading railroad in this city. Petrified shells, fish and insects can be found in innumerable variety at Cincinnati, Ohio. Many of the streets are paved with lime stones made up almost entirely of fossil shells and encrinite stems. Millions of millions of fossil oceanic shells are found in the immense beds of rocks on both sides of the Ohio river for miles. Now, Cincinnati is many hundred miles from the Atlantic ocean, so there is abundant proof that this portion of Ohio was formerly the bed of an ocean during the countless ages that the oceanic fauna here and elsewhere found were being born into existence, and afterwards ceasing to live were turned into stone. Thous-

ands of years must have passed since these immeasurable deposits were petrified. Shells and fishes in the same fossil condition have been found hundreds of feet beneath the surface of the earth in deep sunk mines, or when boring the artesian well. The fires of Etna and other volcanos have been for thousands of years burning up this terrestrial ball, only 8,000 miles in diameter. The earth must be largely made up of carboniferous substances to keep up for so long a time these conflagrations. The mind of man cannot even conceive of their magnitude. These never-ceasing fires must of course be seeking constantly for new elements to consume, and there can be no doubt that there must be a time in the future when the immense cavernous districts in the earth's body must (subject to the laws of gravitation) bring about an almost universal collapse of the circumference, causing the destruction of thousands of cubic miles of the earth's substance, and which series of convulsions must change the character of the earth's surface. Just such changes have no doubt been going on for millions of years, and there can be no doubt that the unknown depths of the ocean were thus made deep through a continuation of these never-ceasing destructions, and as water thrown upon huge masses of burning materials causes unaccountable evaporations, and as such huge bodies of steam contain unlimited power, so when the oceanic waters are allowed to enter these large burning caverns earthquakes must necessarily follow, being of greater or lesser magnitude, according to the volume of water and the extent of burning territory. So as these convulsions are constantly liable to occur, and as disintegration and other forces and elements are also taking place, just as the elements of air are constantly being destroyed and re-formed, acting in concert with the immutable and wonderful laws of God, so it is undoubtedly true that the oceans of to-day may have been in the ages past the continents of the world, and the continents of to-day then oceanic bodies of water. As I've said, any quantity of facts can be adduced beside those mentioned in support of my theories, and I can in truth say that it is only a matter of time when a continuation of these destructive causes shall end in such upheavals that the inhabitants of the earth may be destroyed in one day.

PROOFS.

I will add one or more of well-known statistics to confirm my suggestions.

In 1578 a vessel called "The Busse of Bridgewater," sailing under the auspices of Queen Elizabeth, of England, reached a very large island lying southeast of Friezeland, in latitude $57\frac{1}{2}$. The vessel sailed for three days by its side. In after years this island was sought for, and it had utterly disappeared, no doubt from the effects of an earthquake.

ANOTHER.

In Mitchell county, N. C., for many years there has existed subterranean fires that have destroyed all verdure and trees on the land, and the earth is so hot that you cannot walk on it, and no one has ever been able to account for this phenomenon.

ANOTHER.

At Summit Hill, near Mauch Chunk, Pa., a mine of coal has been burning for thirty years.

ANOTHER.

In the vicinity of Charleston, S. C., on and near the Ashley river, there are billions of tons of teeth and bones of man, fish, quadrupeds and reptiles, all in a petrified condition, and as they are composed largely of phosphate of lime the lands have been purchased by companies, who are digging them up and grinding them and selling them to the farmers for fertilizers. Over 100 square miles of territory are covered by these remains of prehistoric animals, birds and beasts. Bones of sharks are found that indicate the fish to have been a hundred feet in length. Now let your imagination for a few hours have full scope, re-embolden all these innumerable evidences of life with their original forms. Try to conceive of the numerous caravans of land animals and reptiles, and then conceive of the vast extent of water that would be filled with the marine fishes of such huge proportions as they originally existed. Then let the imagination go further and attempt to conceive how it was possible to bring these untold millions of bones of the then living creatures into this vast space, and if your brain is not tired out before your vivid conceptions have taken a form of realization, then my mind and yours are dissimilar. Our lamented Agassis calls this vast burial ground "the greatest cemetery in the world."

ANOTHER.

Over 200 years ago coal oil was found on top of the ground in Harlem, Germany, and this first knowledge of oil remained undeveloped way down to 1854. The Harlem oil was put up in small bottles and sold extensively as a liniment under the name of "Medicamentum." In 1820 the Seneca Indians of New York found a similar oil floating on the surface of Seneca lake, which they collected and used for the cure of diseases. Now since 1855 billions of barrels of oil have been taken from the bowels of the earth, and

thousands of the subterranean oil caverns have been emptied by the ingenuity of men, and the products have been converted into illuminating and lubricating oils, anilines for coloring, fats like spermaceti called vaseline, cosmoline, and paraffine for candles, salves and other uses. Now, these vast numbers of vats of oil are the results of fires during the past ages, which have in the destruction of ligneous and carboniferous materials deposited them.

When the terrestrial fires shall have burned through the crust of earth which now separates them from these innumerable deposits of inflammable oils, then will the magnitude of the fires be greater and increasing until all the carboniferous deposits shall have been destroyed.

Changes.

Let me add one more evidence of the mutability of the earth's surface. Mr. John Fowler, for seven years the consulting engineer to the Egyptian government says that in an average year, the Nile conveys no less than 1,000,000,000,000 tons of water, and 65,000,000 tons of silica, alumina, lime and other fertilizing soils, and substances down into the Mediterranean sea.

Want of Fertilizers.

Let me add another statistic to the very powerful ones in this essay.

To a Pennsylvania farmer it seems almost incredible that in the State of South Carolina the average yield of corn is only eight bushels per acre. In North Carolina it is twelve bushels; in Georgia nine bushels; it is higher in Tennessee than any other Southern State, there running up to twenty bushels. In the Northern States, Kansas has the best record, her average yield being $36\frac{1}{2}$ bushels; Nebraska comes next with 36 bushels. Pennsylvania makes the best showing of all the Middle States with an average of $28\frac{1}{2}$ bushels, closely followed by New Jersey with 28 bushels. There is plenty of room left for better farming all over the country. As the reader can easily understand it is just as expensive to till 40 acres of land in North Carolina and obtain 480 bushels as it would be if properly marled to get 1000 bushels, same labor except in getting in the crops, and that it is exceedingly unsatisfactory to till such poor land, and real pleasure, and profit to gather in from the same land 25 to 40 bushels per acre by simply applying the greensand marl.

The Chemical Composition of Marl—Its Value as a Fertilizer.

When the surface is removed from a deposit of marl and the spade reaches through the earth that covers the greensand, that formation is found with little moisture in it, uniform in color and appearance, of a dark green and slaty hue. The spade cuts it about as a knife passes through a cheese. The lumps or masses as thrown out cling together till they become dry, and then disintergrate and crumble, till a pile that has stood for a few weeks, and especially one that has been exposed through a winter is as fine and mellow nearly as an ash heap. At a short distance a marl pile has a pale green color, with whitish or greyish particles. Taking it up in the hand it gives no gritty feel between the thumb and fingers. Its smell is somewhat that of clay, yet noways pungent nor at all disagreeable. One accustomed to the rank effluvium of the commercial fertilizers doubts whether there is much virtue in a mild looking, nearly inodorous earth.

In all the earlier analyses of marl, the quantity of potash in the specimen was the chief thing sought. Professor Rodgers held that potash was its most valuable ingredient. The first chemist who published an analysis of marl that disclosed the presence of phosphoric acid was Dr. Enderline, a German experimenter, in New York city. He was a friend of Professor Mapes, and that enthusiast in agricultural science hailed the discovery with more joy than if ten per cent. of silver had been found in it. No discovery could be of more importance to the race than of an unlimited supply of phosphorus. We can flourish without silver. We can be rich and never see gold. But phosphorus means bread, and bread means strength and life and joy and hope and progress for the race. The Hebrew and Roman civilizations have left the regions bordering on the Mediterranean sterile and incapable of supporting a numerous and powerful race; because their tillage has exhausted the phosphorus from the soil. England would be well on the way towards the tomb of States were it not that with a sagacity and enterprise worthy of all praise and of universal imitation she draws from other and distant islands and continents, from slaughter houses, from cities, and even from ancient battle fields, and from the tombs and crumbling mummies of old Nile, the phosphorus that next year waves in her generous harvests, and builds up the bones of her noble bullocks. Yet with all her vigilance and enterprise the fields of Great Britain are in a progressive state of exhaustion. "If it were possible," says Leibig, "to restore to the soil of England and Scotland the phosphates which during the last fifty years have been carried to the sea by the Thames and the Clyde, it would be equivalent to manuring with millions of hundred weights of bones ;

and the produce of the land would be increased one-third or perhaps double itself in five to ten years. If a rich and cheap source of phosphate of lime and the alkaline phosphates were open to England, there can be no question that the importation of foreign corn might be altogether dispensed with after a short time." As a rule, the more nutritious a grain or root the more phosphate it takes to grow it. The bean the pea, corn and wheat require it. A field without phosphorus is incapable of growing grain. No plant suitable for food can be profitably cultivated without the co-operation of this substance in some form. Hence, when it became fairly established by the analyses of Enderline, Prof. Cook, George J. Scattergood, R. C. Kendall, and others, that all the genuine greensand marls contain from two and a half to three and a half pounds in a hundred of phosphoric acid, this fertilizer began to arrest general attention, and the most pertinent question a farmer can ask himself is *whether he knows of any way in which he can get two or three pounds of phosphate cheaper than by buying a bushel of good greensand marl?*

The following testimony of Professor George H. Cook as to the composition of the Jersey marls is probably of more importance than the researches of any other chemist. He is at once a chemist, a farmer, and a geologist. He has made the marl formation the study of years; he has visited almost every locality in the State where marl is dug, and examined specimens from hundreds of pits:

"While all other fertilizers are exhausted and the soils become poor, I have to see the first field that has ever been well marled that is now poor. One instance was found where poor and sandy land was marled more than thirty years ago, and has ever since been tilled without manure, and not well managed, which is still in good condition. Occasionally marled fields are seen that do not grow crops as large as they once did, but all their fertility is immediately restored by a dressing of lime; an effect which could not have been produced by the lime on unmarled land."

If you take a sandy loam that has never been fertilized, or a worn out clay soil, and give it a dressing of 20 loads to an acre, we have added about 1,500 pounds of potash, of phosphoric acid 1,400 pounds, of lime 1,300 pounds, of magnesia 700 pounds. A bushel of greensand marl is worth 38 cents to the farmer for the soluble phosphoric acid it contains, and 16 cents for its potash, without considering the value of the lime, silice and iron. Eighty-eight dollars worth of marl at \$3.20 a ton will purchase 1,925 pounds of phosphoric acid, besides as much more of potash of which there is very little in guano. Five hundred pounds of active fertilizers in a ton of fish guano costs \$25; 146 pounds of active fertilizer in a ton of marl costs \$3.20.

Prices of Fertilizers.

To give my readers a still better idea of the costs of the different compositions used I herewith attach an article cut out of the Wilmington, N. C., Review of Oct. 8th, 1883:

FERTILIZERS, @ 2,000 lbs—	Per Ton.
Peruvian Guano, No. 1 - - - - -	\$57 50@62 50
" " No. 2 - - - - -	36 00@37 00
" " Lobos - - - - -	00 00@51 05
Baugh's Phosphate - - - - -	00 00@60 00
Carolina Fertilizer - - - - -	45 00@50 00
Ground Bone - - - - -	00 00@40 00
Bone Meal - - - - -	00 00@45 00
Bone Flour - - - - -	00 00@57 00
Navassa Guano - - - - -	40 00@45 00
Complete Manure - - - - -	00 00@67 00
Whann's Phosphate - - - - -	00 00@70 00
Wando Phosphate - - - - -	00 00@70 00
Berger & Butz's Phosphate - - - - -	00 00@60 00
Excellenza Cotton Fertilizer - - - - -	55 00@60 00
French's Carbonate of Lime - - - - -	7 00@ 7 50
French's Agricultural Lime - - - - -	8 50@ 9 00

The last two articles are sold by one French, who resides only a few miles from Wilmington, and who has on his farm a large deposit of a rock simulating very closely to common chalk. When the mineral carbonate of lime is deficient in the soil its addition in any shape will be advantageous. I will again repeat that the sale and manufacture of artificial composites to apply to worn out soils has made a great advance in a decade of years, and the ingenuity of man has been wonderfully taxed to find the ingredients of a first class super phosphate. The bones of animals which for years have been bleaching uncared for on plains, prairies and deserts, are now being collected and sold to the above manufactories. Picking up the bones of dead buffaloes is one of the industries of

Texas. The bone mills in St. Louis pay fourteen dollars a ton for the best grades of this harvest gleaned by the squaws, who wander about the plains in search of the bleached skeletons. I saw hundreds of tons of bones at the works of the Navassa Guano Company, four miles from Wilmington, N. C., some of them collected in Africa.

Worth Investigating.

Responsible persons have told me that Samuel Butler, of Chester county, introduced, in 1879, a bill to tag all bags of fertilizers with the analysis of each bag, to prevent fraud, and that it met with tremendous opposition from the manufacturers of artificial manures, and was referred back three times before passage.

Lime as a Fertilizer.

"Wherever agriculture has been advanced to the state of an art, universal experience testifies that the presence of lime in a soil is useful. All plants contain more or less of it. Although plants take from 93 to 99 per cent. of their growth from the air, yet the air affords them no lime. This, in order to avail the growing crop, must be mingled with the soil. The plant can receive it from no other source. As soils are formed from rocks, and as most rocks contain more or less lime, it follows that nearly all soils in their virgin state contain more or less lime, enough in most cases to bring good crops without the addition of more. The pioneer farmer, for a few years, seldom has occasion to apply it. Sandy soils, in which there is little or none, required it from the first. Clay soils sometimes contain none, and in this case the addition of lime is of great service. Felspar soils, and those derived from the disintegration of serpentine rocks, usually are destitute of this alkali, and consequently are barren till it is added.

In soils long cultivated it is wanting, for the following reasons: A portion of the lime once in the soil has been carried off in the crops; another portion has sunk too deeply in the soil to be reached by the roots of plants; it is its nature, having a metallic basis, and being divided by the process of slacking into exceedingly minute particles, to sink between the coarser particles of earth to a depth at which it becomes unavailable. If, therefore, you long cultivate a field without liming it, you may well suspect that you have carried off half the lime originally in the soil, and that the other half has sunk beyond the reach of plant roots—though it is quite possible that you might avail yourself of this latter half by plowing four or five inches deeper than before, thus turning the sunken lime up again to the surface.

The objects to be sought by the application of lime are threefold: First, to feed growing plants with as much as the constitution of each requires; second, to change the condition of plant foods already in the soil, so that from being unavailable they may become available, and, third, to so modify the soil, physically and chemically, as to render it easier to cultivate and more productive."

Plant Food in Plaster.

Plaster consists of sulphate of lime, a (combination of sulphuric acid and lime), with some water. Lime and sulphuric acid are both plant food, and so is sulphate of lime itself, which is sometimes found existing in the tissues of plants, especially clover. But plaster has an extraordinary effect upon some crops, as clover, peas, oats, corn and others, and much more than it could possibly exert by virtue of its component parts. This is evident when we find 100 pounds of plaster on an acre of clover sometimes increases the yield as much as 1,000 pounds of hay or even more. How this effect is produced has not yet been explained satisfactorily, but it is a matter of valuable positive experience, and we can afford to wait for the explanation, if it is ever discovered.—*New York News*.

Chemistry of Fertilizers.

A celebrated French chemist named Ville, who has widely experimented, says in his book on artificial manures, that "ten different organic and mineral elements enter into the composition of plants: phosphorus, sulphur, chlorine, silica, calcium, magnesia, potassium, sodium, iron, and possibly magnesium; but with the help of nitrogenous matter, three only are necessary to increase and maintain the fertility of the soil, and the farmer need not concern himself about the other seven; and these three elements are phosphorus, calcium and potassium, and phosphoric acid, lime and potash are simply the oxides of these metallic elements. The other seven are in all soils in an inexhaustible proportion."

Phosphate Rock in North Carolina.

Through the kindness of the chemist, Mr. W. B. Philips, of Wilmington, N. C., (whom I had the pleasure of meeting in that city in October, 1883), I have before me a brief treat-

ise on phosphate beds recently brought to light; and which discovery has produced a deal of excitement in that and adjoining states. The rock is found from five to ten feet below the top of the soil in Duplin county, in beds or layers of from eight to twelve inches thick, and contains twenty to forty per cent. of phosphates of lime.

Now let me say again that in the undeveloped deposits in King William county there are millions of tons of phosphate rock in all shapes, and some of them are exceedingly rich in phosphoric acid, and that when this almost unknown manurial bed, now first brought prominently before the public, is fairly known and investigated, all others will gradually go out of the market. They cannot compete with us; the North Carolina's are difficult to obtain and inland away from railroads while ours are on a navigable river.

Fossils.

I have on exhibition a few of the million of fossil and semi-fossil bones found on the banks of the Pamunkey. I have a portion of a mastodonic looking rib that I should think would if complete measure six feet in length, I picked up many smaller vertebræ and bones, and showed them to the owners of the land where they were found who were utterly surprised. The truth is that the country there is very sparsely inhabited I rode miles without seeing a house, and men like Dr. Croxton, Lewis and others who knew of the deposits, and had tested their wonderful fertilizing properties, had no capital and were not in condition or had the disposition to form stock companies and work them. When after looking at my imperfect collection of these remains of pre-historic animals, birds, fish and of man, and imagine the untold millions of similar ones now in these unopened graves, the only present evidence of extinct life, of myriads of beings, once sporting in their respective elements, now dead and petrified, once full of life, vigor and joy, now unknown except as seen in these relics. When you try to conceive of the multitudes of these remains, scattered over and in this huge charnel bed you are soon filled with amazement, and surrounded with doubt, your littleness and supineness are the more evident to your feeble senses. These fossils represent billions of animals found over a territory of at least 200 square miles, animals and fishes, so large that the elephant by their side would be like pigmies teeth, tusks and bones of the cetaceous family, vertebræ of elephants, of the Rhinoceros, mastodon, deer, horse, elk, hog, etc., mixed up with human bones, and tools of a race of men of whom we know but little. God only understands how, when and where destroyed, and brought together so promiscuously, and how so many millions of them are here congregated.

Fossils Everywhere.

Mr. John N. Emery, of New Castle, Pa. a brother of Senator Emery, kindly related to me to-day (Aug. 4th, '83) the following: In July, 1882, he was residing in Grainfield, Gore county, Kansas, and a well some 173 feet in depth gave out, and, as there was no other well or water near for many miles, the settlers were much annoyed, and he proposed descending the well, provided they could find a strong rope, which was done. At a depth of about 115 feet he noticed, by the light of his lantern, a stratum of blue shale and in it he saw a portion of the head of a fossil shark. He procured some of the teeth, one of them was two inches long, and the whole fish must have been at least 40 feet long. And he further states that fossiliferous rocks are excessively abundant in the State, and in some places they saw out sections of them and build houses from the blocks, which harden by exposure.

China Fossils.

The prehistoric remains of fishes, shells, etc., are very common all through China, and the wisest of the race have been unable to explain their origin, they suppose them the work of their gods and devils. While boring an artesian well in Santa Clara valley, Cal., the stump of a redwood tree was found 28 feet from the surface. In the valley of the Connecticut river, 80 feet from the top of the quarry, immense tracks of gigantic birds are found.

Fossils.

Insects and vegetable matter called infusoria are found in beds 20 to 30 feet deep at Richmond, Va., also in Germany, extending over hundreds of miles of territory. Prof. Baley estimates the number of separate structures in a cubic inch of such earth in Maidston, Vt., at 15,625,000,000. Fossil shells are found in the Alps thousands of feet above the ocean level, also found on the Himalaya mountains 16,500 feet above the sea. Senator Emery owns an oil well (so I am informed) where they procured fossils from its bottom 700 feet deep. Fishermen on the English coast brought ashore in thirteen years 2,000 grinders of mammoths, besides other fossil bones. Immense number of fossil bones have been found in Carrs, in Yorkshire, England. Dr. John C. Warren, of Boston,

bought, in 1830, the bones of a mammoth that weighed 2,000 pounds and was 25 feet long. Prof. Owens speaks in one of his books of having secured a fossil shark's tooth six inches long by five wide, and that the largest sharks now known to exist are about 37 feet long, and have teeth two inches long and nearly two broad. The fossil tooth now in my hand is $8\frac{1}{2}$ inches long and five inches wide, and must have belonged to a fish over 100 feet long.

More Fossils.

Col. Mantor, who for many years was located in this city, says that in the vicinity of his home there are lots of petrified beech and other nuts, and that in Cleveland, Ohio, an artesian well was bored 2200 feet deep, and at its greatest depth the drill brought up clay rock full of fossils. He also told me that at Fargo in Dakota territory, after boring 585 feet they struck a three feet strata of fossilized shells.

More Gigantic Fossils.

The San Luis *Obispo Tribune* says. Most of the residents of this place are familiar with the large fossil shells found in this vicinity, but few have seen the enormous one brought here from Santa Margarita by Rev. Wm. Summers. It measures $16\frac{1}{2}$ inches in length, 8 inches broad and 23 inches around the thicker part. It was found 978 feet above the level of the sea, some of them are found at altitudes of 2000 feet above the sea.

Changes in the Earth's Structure.

Since the creation of our mundane sphere there has been a continuous, never ceasing series of changes taking place, growth and decay. Carboniferous matter is now and ever has been constantly burning. This destruction of matter forms larger or smaller cavernous openings, and the destroying volcano is eating up all burnable material in its vicinity, and hence convulsions and earthquakes must necessarily occur. Recently a tremendous upheaval was discernible in Grand Traverseburg, Lake Michigan. It has been seen before. The horrible slaughter of men and women at Ischia is fresh in our memories. Etna, Vesuvius and hundreds of other volcanoes never die out. Others remain quiet externally for years. The Yellowstone Park is full of volcanic upheavals. A country seat in Norway sunk into an abyss 300 feet deep in 1702, and the spot was instantly covered with water, drowning fourteen persons and 250 head of cattle. Geological examination reveals in the delta of the Mississippi, along a space of 300 miles, ten distinct forests of buried trees. Bald cypresses with a diameter of twenty-five feet have been found. A geologist, Dr. Julien by name, has tried to tell the number of years that it takes each variety of stone exposed to atmospheric changes to be destroyed, and proves that many of them are ruined inside of 100 years. The island of Hawaii is entirely of volcanic origin, and it is 90 miles long. A volcano on the isle in 1852, in the space of twenty days, threw up a cone a mile round at the base and 400 feet high, and the flames threw up a column of fire 700 feet high. There are hundreds of extinct volcanoes on the Pacific coast.

At Oxenhall, England, in 1179, the earth suddenly rose to an eminence resembling a mountain remaining so many hours; it then sank as suddenly with a deafening and terrific roar, leaving a deep chasm.

The Guleu river in Norway buried itself underground in 1344, but soon after burst out and destroyed 300 persons, with several churches, houses, etc.

On a Saturday evening, February 17, 1571, Marcley hill, near Hereford, England, began to move from the base; it continued in motion until the subsequent Monday; carried along with it trees, hedges and cattle; it overthrew a church, demolished everything in its way, and at last settled into a mound forty feet high, leaving a chasm forty feet deep in its path. In 1586 a similar phenomenon happened in Dorsetshire, England. A field of three acres, with trees, fences and cattle, moved from Blackmoor to Hearn and settled there.

In 1618 the town of Pleurs, Italy, was buried by a slice of the Alps falling, and 2,000 people were killed. A town near by was buried in like manner in the thirteenth century.

Spearing for Timber.

A new industry has recently been developed in Ireland—a sort of timber prospecting never dreamed of by our American pine hunters. It is a well known geological fact, says, the *Northwestern Lumberman*, that large tracts of what are now bog lands in Ireland were once covered with forests of oak and pine, and that in cutting peat, large trees of these varieties are found imbedded in the earth at depths of ten, twenty and thirty feet, in many cases whole groves being found standing just as they grew. To find out the location of these miniature subterranean forests is now the speculative work in which some industrious Irishmen are engaged. The timber, when brought to the surface, is

found to be perfectly sound, and the oak, which is as black as ebony, is used extensively for ornaments of jewelry and fancy cabinet work, and sells at high prices. A recent visitor to the wild moor and mountain region of Donegal thus describes the way in which the seekers after buried forests operate. Two men, armed with steel rods about thirty feet long, traverse the bog, and by running their rods into the ground are able to ascertain where the trees are to be found. They work by what may be termed natural mathematics, and quickly determine the length of their prize, its approximate diameter, whether it is pine or oak, and is or is not a clumper—one of a company or clump. They fix on twenty or thirty feet square, and cross it with their searchers, say north and south, and then east and west, search it across each way, a stab to each foot or so, and in the course of a few minutes they know whether that area contains what they are looking for. The square lying next and next, and all near each other, are examined, and the discoveries, if any, marked for future action. The unproductive are also marked, to avoid future loss of labor.

Mark Twain on Science.

In his new book Mark Twain calculates: "The Mississippi, between Cairo and New Orleans, was 1,250 miles long 176 years ago. It was 1,180 after the cut-off of 1722. It was 1,040 after the American Bend cut-off. It has lost sixty-seven miles since. Consequently its length is only 973 miles at present. Now, if I wanted to be one of those ponderous scientific people, and 'let on' to prove what occurred in the remote past by what had occurred in a given time in the recent past, or what will occur in the far future by what has occurred in late years, what an opportunity is here! Geology never had such a chance, nor such exact data to argue from! Nor 'development of species,' either! Glacial epochs are great things: but they are vague—vague. Please observe:

"In the space of 176 years the Lower Mississippi has shortened itself 242 miles. This is an average of a trifle over one and a half miles a year. Therefore, any calm person, who is not blind or idiotic, can see that in the old oolitic Silurian period, just 1,000,000 years ago next November, the Mississippi river was upward of 1,300,000 miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And, by the same token, any person can see that 742 years from now the Lower Mississippi will be only a mile and three-quarter long, and Cairo and New Orleans will have joined their streets together and be plodding comfortably along under a single mayor and board of alderman. There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact."

Singular.

A tree standing perpendicularly has been discovered at a depth of 280 feet in boring an artesian well at San Bernardino, Cal. Great pieces of wood, which appear to be sycamore, are brought up.

Another Fact.

In a petrified forest of 300 acres extent recently discovered in the Buckskin mountains on the Arizona side of the Colorado river, there are trees twenty inches in diameter, and not a leaf of vegetation which is not turned to stone.

Shooting Stars.

Another evidence that the earth is constantly undergoing changes which must in some measure disturb its equilibrium is in the fact that some astronomers have calculated that 400,000,000 meteors of larger or smaller magnitude fall to, or are attracted to our earth every 24 hours. Some meteoric stones weigh 25 tons.

Ancient Earthquakes in Ischia.

The most ancient of the recorded eruptions in Ischia was that of Montagnone, to which is ascribed the origin of the vast crater of regular form that still existed before the recent earthquake, in a state of perfect preservation, in the northwestern part of Ischia. About 470 B. C., successive eruptions at Point Comacchia gave rise to the vast flow of Monecoco and Bale, which extended far into the sea and prolonged the point to the north. Numerous efforts have been made since these ancient times to plant colonies on this unstable land, even then fertile and covered with a luxuriant vegetation.

Lyell, who made a long exploration of the island in 1828, relates that first the Erythreans and afterward the Chalceideans, who had settled on the island before the Christian era, were driven away by the incessant earthquakes and the mephitic exhalations escaping from every point. At a later time, 280 B. C., Hiero, king of Syracuse, tried to found a colony there, but it was soon driven away by a formidable explosion preceding the great flow of lava which gave rise to the masses now forming the promontories of Zaro and Camso.

The same fate befel the Grecian colonies which afterward tried at different times to occupy the island. The eruption that forced the retreat of the first Grecian colony gave rise to Monte Rosata, that cone of projections, the sudden formation of which is comparable to that of Monte Nuovo. The last named mountain was raised in September, 1538, in forty-eight hours, at Puzzuoli, after a succession of formidable shocks which occasioned great disasters in the Phlegrean fields and destroyed a great number of Roman buildings. These two mountains of volcanic erection, formed under similar conditions, at two distinct epochs corresponding in each case with a period of repose in Vesuvius, and distinguished by their regular form, which may be compared with that of the classic volcanoes of the chain of the Puy's of Auvergne. Both, terminating in a vast crater, have emitted, like the volcanoes of Auvergne, only a single flow of lava, which seems to have exhausted all their energy. A long period of repose followed. During more than a century "Ischia the Joyous," as it was called, rested in perfect tranquility. The pleasure-loving Romans made of it the most enchanting resort in the world; all their magnates had villas there.—*Popular Science Monthly for November.*

I have given these various facts and statements merely to prove beyond any controversy that it is all irrational for any geologist to attempt to give dates for the different formations of the earth's crust or of its whole substance. These volcanic fires have been going on for thousands, may be millions, of years, and there is not (probably) a cubic mile of the earth that has not been disturbed, changed or disintegrated during these lapse of years, and hence any attempt to explain how the enormous quantity of marl and fossil bones came together in Virginia is also foolish, and unwise. The whole matter is inexplicable.

Navassa Guano Company.

The extensive works of this very enterprising company is on the Cape Fear river, above Wilmington. Through the courtesy of its gentlemanly proprietors, I was taken to them in a steamer. They have certainly every variety of machinery necessary to break up and triturate the Nevassa rock obtained from an island near Hayti, as well as the South Carolina rock. The Nevassa rock like the South Carolina contains in its natural state from 10 to 47 per cent. of phosphate of lime. They manufacture on a huge scale their own sulphuric and muriatic acid, employ constantly an intelligent chemist by the name of Phillips, and they are making and selling a large quantity of these different grade fertilizers at from \$34 to \$36 a ton at Wilmington, N. C.

Acme Manufacturing Company.

Another organization is just being started at Wilmington, North Carolina, called by the above name, who are going to make a fertilizer from the South Carolina phosphate rock, cotton seed and marl, with chemicals. Their works are located about 17 miles from the city at Cronly. Other organizations to make artificial fertilizers are starting up like mushrooms in almost every state. The demand for them is steadily increasing.

Phosphates.

While in Charleston, S. C., inspecting and investigating the methods of procuring the phosphate rock, I called upon Prof. C. U. Shepard, a distinguished chemist, who has for several years been in the employ of the State in the development of the phosphate rocks found in its midst. He presented me with two works. The first being a report of the Commissioner of Agriculture of 1880, containing a very large amount of information on the methods of collecting, washing and preparing the rock, the number of companies engaged in obtaining it, &c., which I shall now briefly quote from. Before doing so, let me say that a gentleman named Mr. A. Butterfield showed me much respect in giving me all the information he could and also showing me some fine specimens of the fossil remains of elephants, mastodons, sharks, &c., found in the phosphate beds. Also, I am much indebted to Mr. C. A. Scanlan who showed me a very large collection of these fossils and presented me with a handsome variety, as did Mr. Butterfield also.

Hon. A. P. Butler, the commissioner of South Carolina, says: Over 100,000 tons of fertilizers, valued at \$3,000,000, were made in South Carolina in 1879. The amount of phosphate rock mined and shipped in nine months was 53,000 tons, and that ten companies and five separate firms were engaged in the work, as separate companies and organizations, employing a large number of men and vessels, one company using 40 flatboats in procuring the rock from the Steno river, and that the rock was found in marshy places over a large area of territory in varying veins averaging only eight inches thick. After being taken out of the earth by dredging and other methods, it was taken to large costly buildings, where it was broken up and washed, and after drying was ready for shipment to the manufacturer, who then pulverized it finely and prepared it in various ways, by the aid of sulphuric and muriatic acids, for the farmers. When so prepared it sold where made for \$25 to \$35 a ton. Page 38 of this volume

contains a letter from Col. W. P. Starke. He says the phosphate deposits are supposed to underlie 250,000 acres; the accessible deposits comprise an area of about 10,000 acres. *Edward Ruffin, in 1844, computed the wealth added to Virginia by the discovery of her marl deposits to be \$500,000,000.*

NOTE.—Let me right here inform the reader that the declaration of Mr. Ruffin refers to the deposits which have now been secured by the writer on the Pamunkey.

Prof. Shepard, page 68, says: The coast of South Carolina presents few elevations; back for miles the land is low and swampy, and in these swampy morasses the phosphate rock is found at greater or less depths, but usually within a few feet of the surface. The average yield is about 750 tons to the acre. Owing to the level character of the country where the mining is done by excavating, steam pumps have to be used to keep off the surplus water. Page 79, Prof. Shepard gives a fine engraving, showing the vast building used by the Charleston Mining Company for the purpose of washing the rock. Page 80 says: It is not unusual to observe the laborers diving into water six to ten feet in depth and bringing in their hands to the surface the phosphate rock. Page 81: A very considerable part of the rock is excavated by dredging boats. Page 84: The total production to date of the rock is about 1,500,000 tons, worth, at \$6 a ton, \$9,000,000. Page 93: The principal competitors of South Carolina phosphate rock in the world's markets are the Peruvian, Brazillian and rock guanos, fossil bones and coprolites, and phosphates of mineral origin.

Great Britain imported, in 1844 to 1873, 1,250,000 tons, valued at over \$3,000,000. The British consul at Callao says, in 1873, that Peru did not then possess 3,000,000 tons of exportable guano.

Without directly quoting any further from above work let me say that throughout Europe there has been herculean efforts made to find phosphorus in some shape in the bowels of the earth, and that every variety of stone containing phosphate of lime has been sought for; and that accidentally (at first) a curious fossil, called coprolite, was found and thousands of tons have been mined in England, Spain and elsewhere, which fossil is the petrified excrementitious remains of extinct animals, or partially digested substances which have been petrified, and that they vary in shape and size from a few ounces in weight to one or two pounds, and that three separate deposits of these curious substances were found in France, viz., the Boulogne, the Ardennes and the Bellegarde, and that the annual product of these beds were, in 1872, 25,000 tons. The cost to mine and grind them is about \$10 a ton.

In Germany is found a stone called phosphorite, which, although very valuable, is or has been very expensive to obtain. The same stone has been known for many years in Spain.

In Canada a stone of similar character has been found called apatite; it is found associated with gneiss, feldspar, mica, etc., and when separated for use as a fertilizer is quite expensive, say from \$10 to \$15 a ton. It is found in Ottawa, Kingston and Perth. Dr. Sheppard presented me with a work entitled "Foreign Phosphates." Let me make a few quotations from it. The history of commercial manures is essentially that of the practical recognition of phosphoric acid. The use of bone and many clippings from the button factory of Sheffield, England, by neighboring farmers was probably the first application of purely phosphatic manures. This discovery was accidentally made about 1750. In 1774, Hunter first publicly advised the use of bones for manure. It was only through the experiments of the celebrated chemist, Justus Von Liebig, based on the researches of de Saussure and others, that phosphate of lime was thus recognized. A factory for grinding bones was put up in Hull, England, and the consumption of bones became enormous. Bones were sought for in all parts of the world, the result was, *worn out land became again valuable*, and the land advanced largely in price. In 1872 97,778 tons of bones worth over \$30,000,000 were imported into Great Britain. Then began searches for phosphoric acid in some other shape, and the apatite (phosphate of lime) was found in Estremadura, Spain, and since that time the constant study of scientists has been to find this wonderful element to return to the mother earth in order to keep up a supply of vegetable matter for all mankind. And let me here interpose another sentence, viz: If all lands in the world were at once deprived of this ingredient, in a few decade of years the population of this world would be dead, if there was no method of supplying this element. Hence the wonderful provision of God to furnish it to us from so many sources.

The North Carolina Experiment Station sent me a pamphlet entitled, "Analysis and Valuations of Fertilizers," up to May 1883, introduced into their State, and I find over sixty different firms represented as manufacturers of artificial manures. To the uninitiated this will give an idea of how rapidly the demand is increasing for these artificial helps to the farmer, and what a large number of companies are now engaged in preparing them. Twenty-eight millions of our people are directly or indirectly dependent upon the products of the farm. The value of our farms, according to the last census, was

\$10,197,163,905. The yearly product is now nearly, if not quite, \$4,000,000,000. The value of the grain crop of California for the last ten years was nearly double the value of the gold and silver taken from its mines during the period. We have more than 5,000,000, farms, and out of the \$883,955,047 of our foreign exports, \$729,560,016 were agricultural.

Further Statistics.

Eighty-five thousand tons of fertilizers were disposed of in this State in 1881, at an average price of \$30.80 for the acid phosphates, and \$40.30 for the ammoniated phosphates. The State probably paid (so says the Agricultural Reports), \$3,600,000 for the various fertilizers.

Marl of New Jersey.

I copy from N. J. State Reports of 1876, the following, page 173: The importance of this natural fertilizer to the farming interest is so great etc. The state of the marl trade is much better.

AMOUNTS SOLD IN 1878.	TONS.
Freehold and New York Railway Co. sold	4,050
Squankum Marl Co.	7,500
Squankum and Freehold Co.	10,000
Cream Ridge " "	4,710
Pemberton " "	10,000
Vincentown " "	3,010
Fostertown " "	5,500
Kirkwood " "	5,300
West Jersey " "	11,000
Woodstown " "	3,000
Total	64,070

All the above tons were carried on the railroads, and it is but a small part of the whole quantity they carted and used in the state. Mr. O. C. Herbert, U. Smock and C. H. Conover, sold to be carted away from their pits 19,564 tons.

Certificates.

Hundreds of declarations concerning the wonderful advantages of the N. J. marl have been printed in the state newspapers, and in their Agricultural Reports. Let me copy a few from a volume before me entitled, "Greensand Marl of N. J." by I. B. Lyman, Agricultural editor of *Hearth and Home*, and from the pen of the State Geologist Prof. G. H. Cook.

I. G. Shult, of Jamesburg, N. J. says: I have used the marl for 28 years. When I commenced my neighbors laughed at me. I used it on grass, potatoes and wheat. Its effects are astonishing. It gives a body to the land that no other fertilizer will. It is the cheapest. On buckwheat it has no equal.

I. Higgins, of Dayton, N. J., says: I do not know what our farmers would do without it. *Manufactured fertilizers cannot be compared to it. A field well covered with greensand marl will last for years, while our fancy priced fertilizers have to be renewed every year.* Marl costs me about one-eighth the price of guano.

Henry Van Dyke, of Jamesburg, says: Marl has made my land, and more than doubled my crops; it is the cheapest fertilizer ever known, as the land seems to never lose its good effects.

A. Redmond, of Jamesburg, says: The increase of rye and straw from the use of 125 bushels of marl to the acre was marvellous.

Hundreds of similar statistics could be here introduced. They only state the same facts over and again in different words.

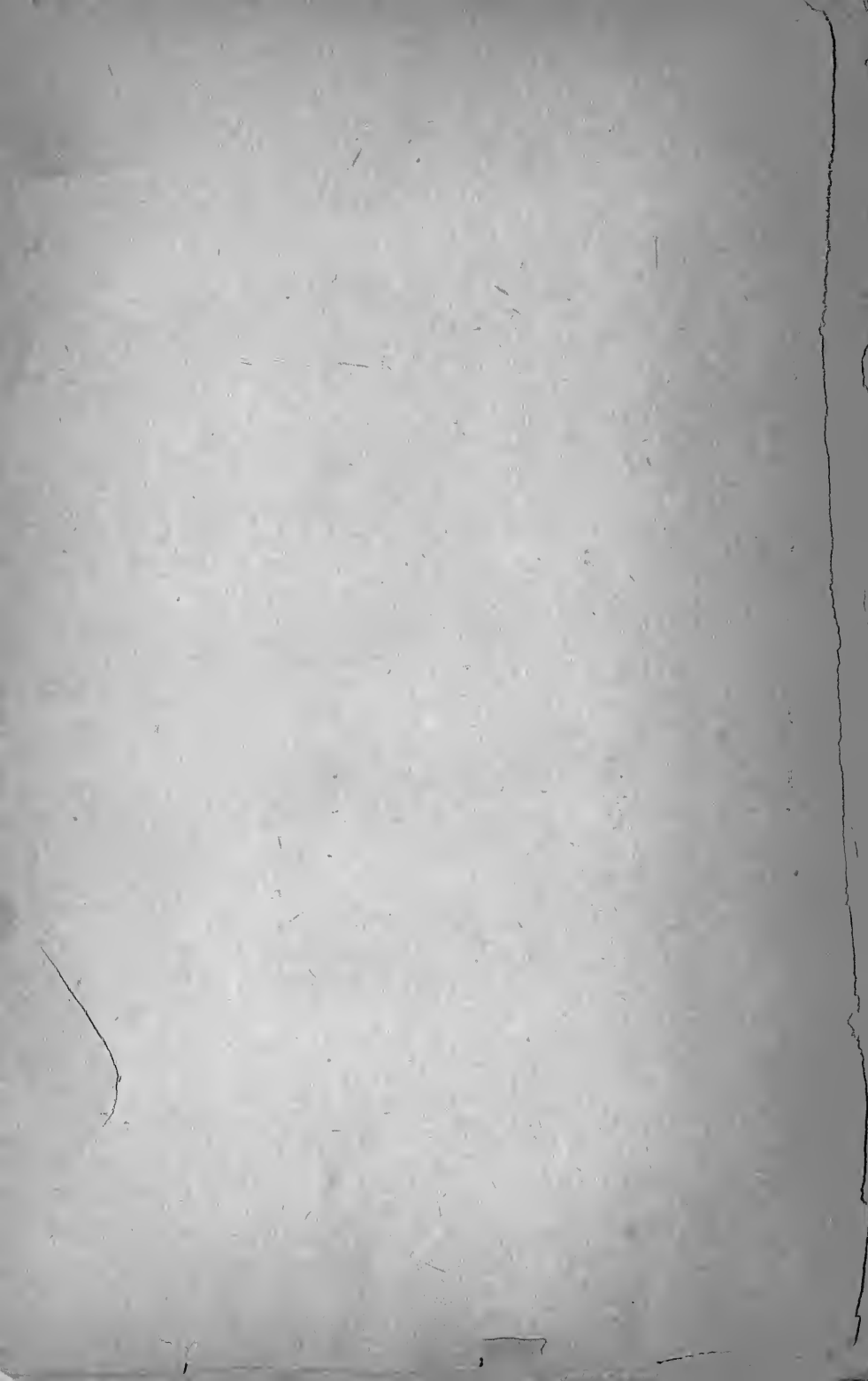
More Explicit.

That I may not be misunderstood upon the matter, I will plainly say that I believe that the composition and comminution of substances in the greensand marl of Virginia must make it superior for fertilizing purposes to any marl ever before discovered or known in the world.

NOTE.—From sixty to eighty bushels of shelled corn was taken from each acre of land that I saw on the banks of the Pamunkey, in August, 1883. Referred to in the pamphlet.

Monied Inducements.

The first question a business man asks is the following: Is there money in it? I answer decidedly, Yes. Millions of dollars worth of marl are now quietly waiting to be



taken up and converted into untold wealth. There is no risk whatever. The competition is very slight, not one per cent. of what it is in a coal mine. All the available land containing marl on the Pamunkey river is in our hands, with a few exceptions. We have millions of tons within a few miles of West Point, and fortunes can be made by 1,000 stockholders, and beside the money made from the ready sale of the marl to hundreds and thousands of farmers who now want it, who can be easily reached by the thousands of flat and canal boats, lighters, sailing vessels and steamers, there is thousands of dollars to be easily made in the increased valuation of the company's lands. Large villages can be built up within a decade of years on and near the banks of the beautiful Pamunkey. The sale of lots will make all investors rich. On land now owned in fee by the writer some twenty-five miles from the mouth of the river, I expect to see erected a capacious hotel, say at Manquin, where thousands of Northerners who have never seen the beauties of the sunny South may stay for a day or a week and see the wild wood flowers. Steamers will run from West Point up the river every day. You can for less than \$10 leave almost any of the cities of Philadelphia, New York, Boston or Baltimore and enjoy a delightful sail on the Atlantic ocean and Chesapeake bay, up the York river to West Point, up the Pamunkey to, say Manquin, about 30 miles from West Point, stay over night, and return home.

Vacant Lands.

On each side of the Pamunkey are thousands of acres of land (many of them worn out) now only needing the marl to grow any crops. These lands can be bought very cheap.

Some gentlemen interested in the Shenandoah Valley railroad thought they would try a little town building. They bought a number of farms at the point where their road was to intersect the Norfolk and Western, and started a city which they called Roanoke. This was about five years ago. The city now has 8,000 inhabitants, shops, factories, long streets of stores, water-works, fine hotels, and is a marvel of rapid growth. The company has spent nearly \$1,000,000 in improvements, reserving from the sale of lots only enough to make interest dividends on their stock. They could close out what property they now have for four or five millions profit, but have no idea of doing so, as by selling gradually they will make much more. The profits on the city of Roanoke, which was considered a small speculation at first, if cashed at once, would nearly pay for the building of the Shenandoah Valley road.

Fifty such towns can be built near the Pamunkey in the next twenty years.

Clover.

It is a singular and pleasing fact, that when the greensand marl of Virginia is applied to barren lands, after the first crops have been gathered in, clover almost universally makes its appearance.

Super Phosphates.

If after an organization is well under way, and agencies are properly established, and marl is being generally distributed to farmers throughout all the Atlantic States, the companies now making artificial manures still remain in existence, they must use up a large quantity of our marl as the basis of their fertilizers, to economize and approximate to us in price of the compost.

Now, I am ready to meet any gentlemen, singly or otherwise, and give further exhibitions concerning the starting of a stock company to mine and sell the marl. I am prepared to answer any inquiries about the matter, and ready to go with a committee, who shall represent the stockholders, and see these lands. I have ninety-nine years lease for all the available river frontage, with a few exceptions. The first marl reached in going up the Pamunkey is ours by lease, with the privilege of purchase.

Further information can be obtained by addressing

DR. C. A. GREENE,
Harrisburg, Pa.

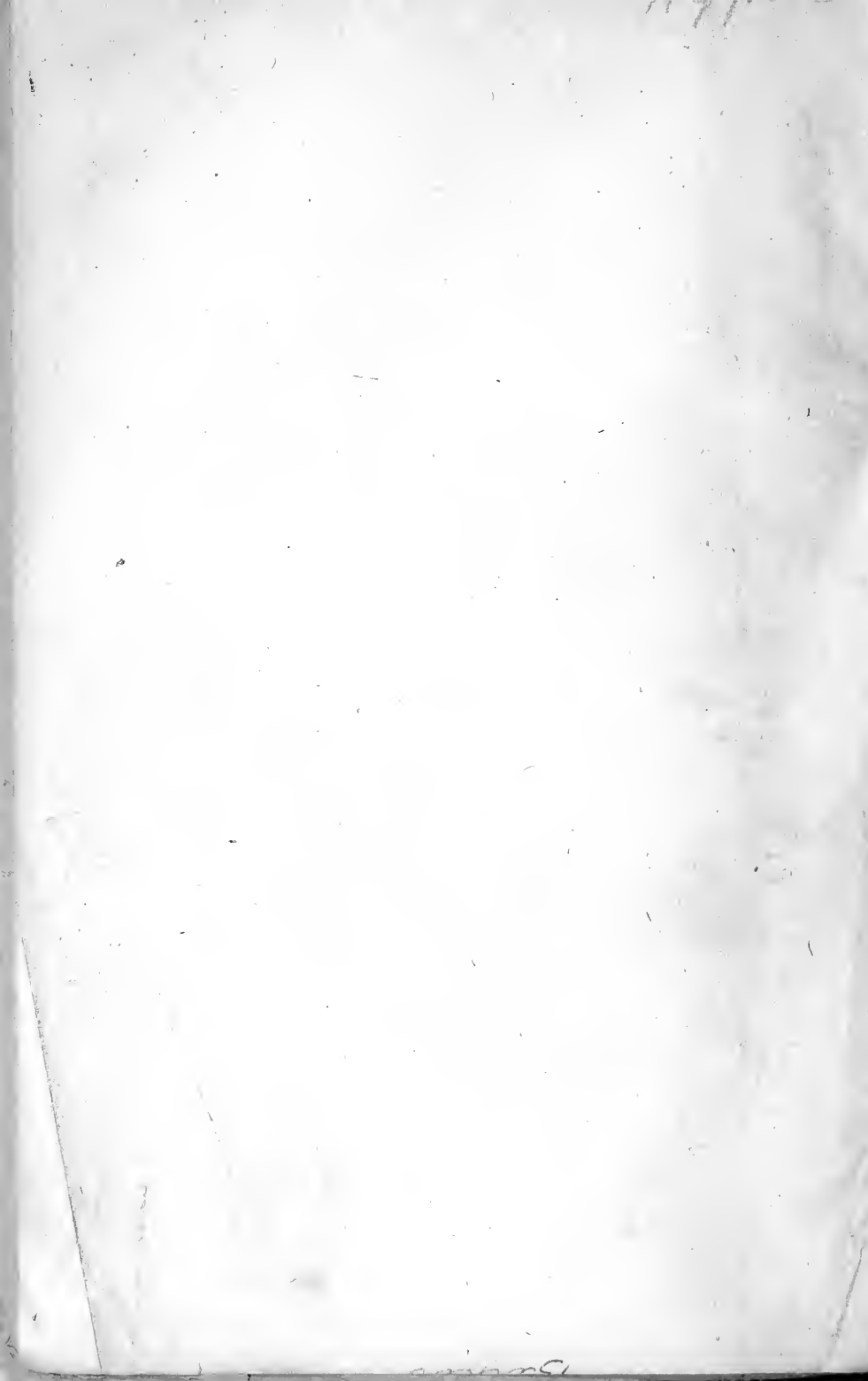
Note.

My partner, Mr. William M. Stehley, who has for sixteen years been living on the banks of the Pamunkey, is now prepared to ship 10 or 500 tons of the greensand marl to anyone who wishes it while I am organizing companies. His address is.

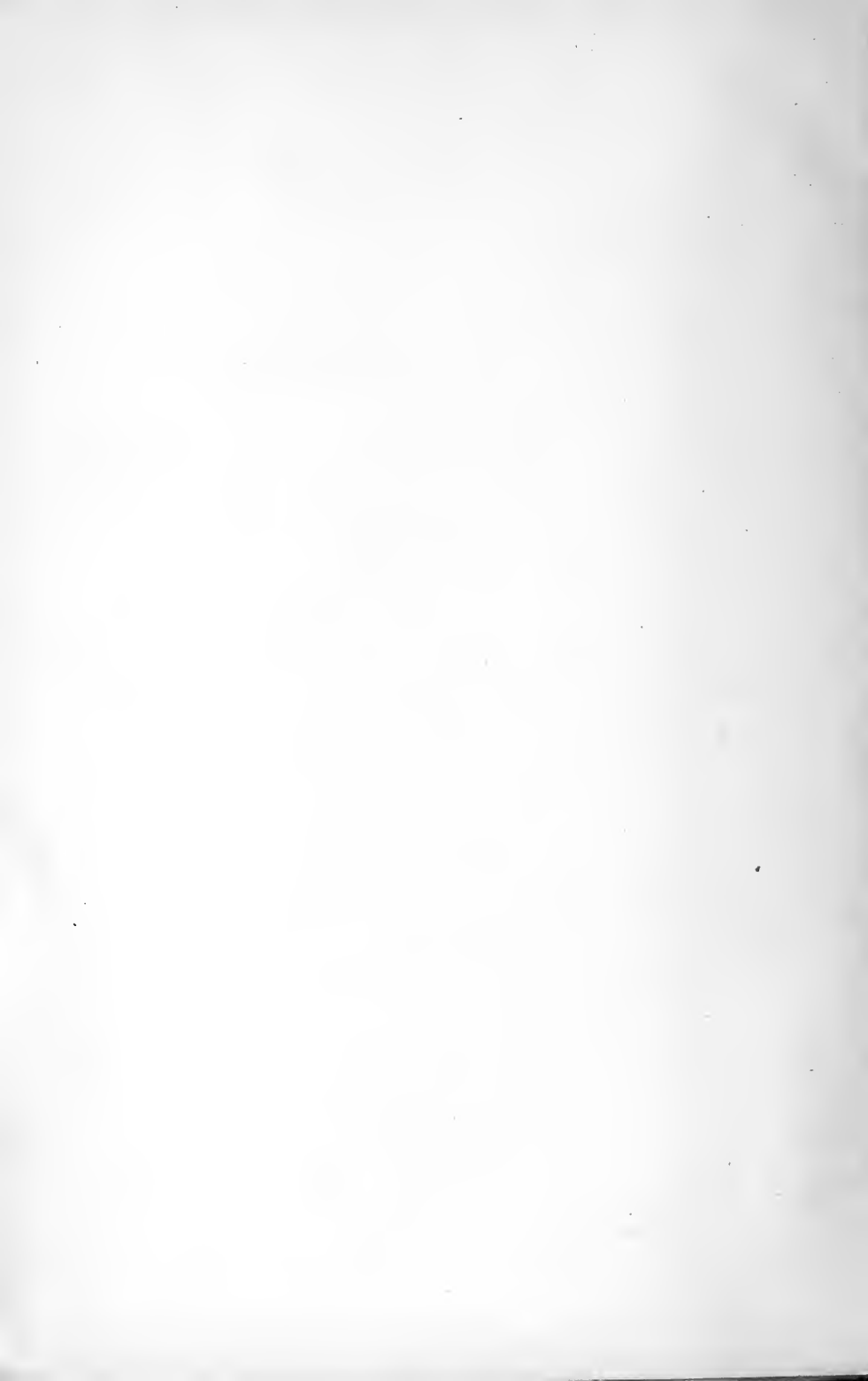
MR. WILLIAM M. STEHLEY,
Manquin, King William county, Virginia.











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